

ROADS AND STREETS

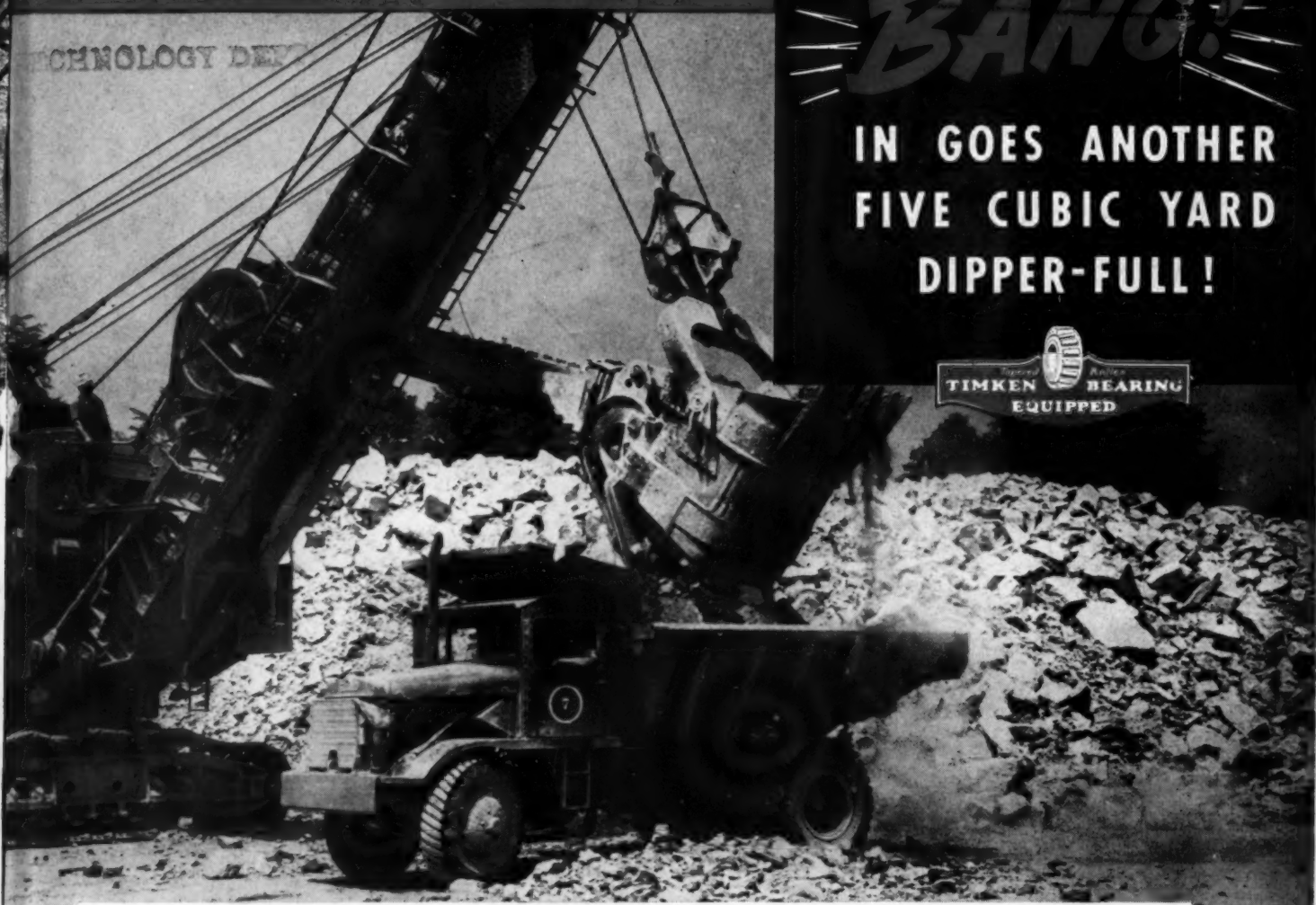
NOVEMBER 1946

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BANG!

IN GOES ANOTHER
FIVE CUBIC YARD
DIPPER-FULL!



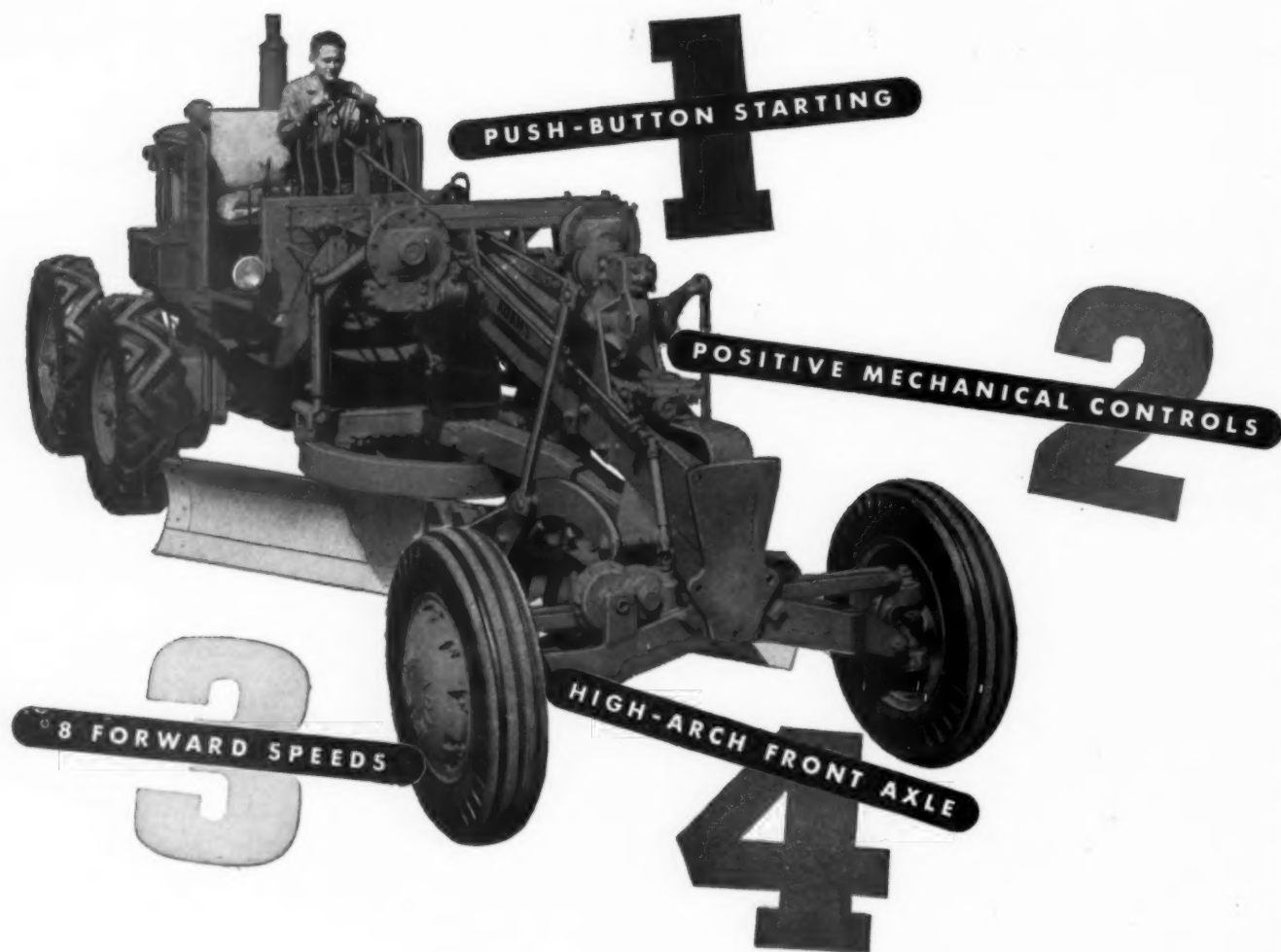
PHOTOGRAPH COURTESY THE EUCLID ROAD MACHINERY CO., CLEVELAND, OHIO AND BESSEMER LIMESTONE & CEMENT CO., BESSEMER, PA.

This Euclid Model F Rear Dump Truck looks small alongside the big 5 cubic yard Marion Electric Shovel, but it can hold and haul a 15 ton load with the greatest of ease! The manufacturer has seen to that by sound design, sturdy construction and the use of Timken Tapered Roller Bearings on all axles. The Marion Shovel, too, is equipped with Timken Bearings at important hard service points. Because Timken Roller Bearings are *more* than anti-friction bearings; because they also can carry

radial, thrust and combined loads; because they are tremendously shock-resistant; and because they hold moving parts in permanent alignment they are definite and far-reaching factors of increased strength, endurance, dependability and extended life in all kinds of equipment. It will pay you to have Timken Bearings in the equipment you buy or build; and make sure the trade-mark "TIMKEN" is stamped on the cup and cone of every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

let tells
of Com-
ts rust,
it and
ears of
a single
ay save
Write



Only Adams Offers These 4 Big Features

Only in an Adams Motor Grader will you find *all four* of these important operating features—every one of which is essential to the kind of fast, efficient, economical performance you have every right to expect in the motor grader you buy:

1. **Push-Button Starting** starts big Diesel engines quickly, easily—even in the coldest weather.
2. **Positive Mechanical Controls**—Adams highly accurate and dependable mechanical control system operates all controls at constant, uniform speed—even when two or more adjustments are being made simultaneously.

3. **8 Overlapping Forward Speeds** provide exactly the right speed for every grading operation—plus high transport speeds for fast travel from job to job.

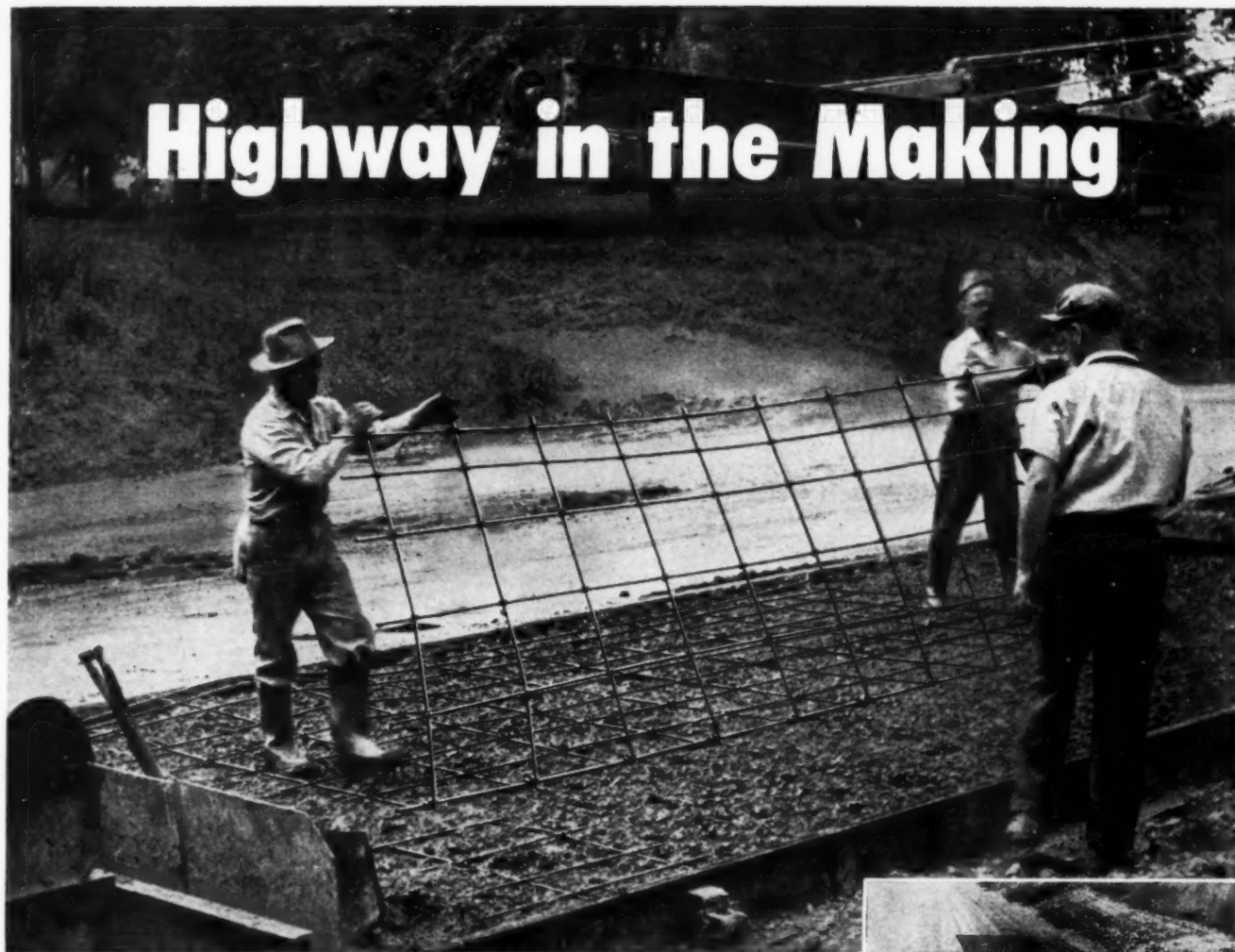
4. **High-Arch Front Axle**—A distinctive feature that enables Adams Motor Graders to straddle and move big windrows of earth and oil mix—without bulldozing material with axle—without waste of power or loss of speed.

These are only a few of the many major advantages that make Adams your best motor grader buy. See your local Adams dealer for complete information.

J. D. ADAMS MANUFACTURING CO. • INDIANAPOLIS, INDIANA



Highway in the Making



Because Bethlehem hinged bar mats can be folded to about half of the standard mat size, they can be handled by two men, and easily trucked without exceeding the road-width limit set up by state highway departments.



These on-the-job photographs were taken near Avon, N. Y., during construction of a six-mile, two-lane stretch of Route 5—through highway from Albany westward to Buffalo. Built for New York State Division of Highways by the Potter-DeWitt Co. of Pavilion, N. Y., this new section required 62,000 sq yd of concrete. Bar mats and other steels for the job were furnished by Bethlehem.

Many contractors regularly turn to Bethlehem whenever they need steel to build a highway or high-

way bridge. Bethlehem steel service saves time and money. You can obtain from this one source practically every type of steel needed to build a modern highway or bridge. And Bethlehem handles your order as a unit, with individual items scheduled to reach the job when needed. You avoid a lot of needless follow-ups, and minimize bookkeeping.

Next time you have a contract for a highway- or bridge-building job, regardless of size, put your steel requirements up to Bethlehem.

LEADING BETHLEHEM HIGHWAY PRODUCTS

Road Joints	Reinforcing Bars
Bar Mats	Guard Rail
Guard Rail Posts and Brackets	
Wire Rope and Strand	Hollow Drill Steel
Fabricated Structural Steel	
Sheet and H-Piling	Spikes
Timber Bridge Hardware	
Bolts and Nuts	Tie-Rods

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation

STEEL for HIGHWAYS



When writing advertisers please mention —> ROADS AND STREETS, November, 1946

ROADS AND STREETS

Vol. 89

November, 1946

With Roads and Streets Have Been Combined
Good Roads Magazine And Engineering &
Contracting

In This Issue

Coming Articles

In December:

Mesh Reinforced Hot-Mix Overlay

How reinforcement was used experimentally to keep joints in old pavement from showing through the surface

Modern Stabilization Methods on a Soil Cement Airfield

How contractor saved labor, speeded job with new Single-Pass stabilizer on mixing

"Contractors at Work"

Continuing new pictorial series; this time a California project

Center Striping Problems, Methods

Summary from various state highway departments

Curing Slides with Drain Tunnels

How Oregon sinks test holes, plats the slide area, locates the slippage line, then tunnels in to tap the ground water

Tests on Gutter Inlet Design for Expressway

By E. C. Woodward, in connection with Fort Worth expressway plans

And a dozen other features

In January:

Two-way radio for traffic signal maintenance . . . Field survey methods expediting Los Angeles expressway construction . . . Reports of national highway convention sessions . . . More articles on pavement marker and road sign practice . . . Many pages of contractor job stories and labor saving kinks . . . Other features

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A magazine devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations, and to the construction and maintenance of airports.

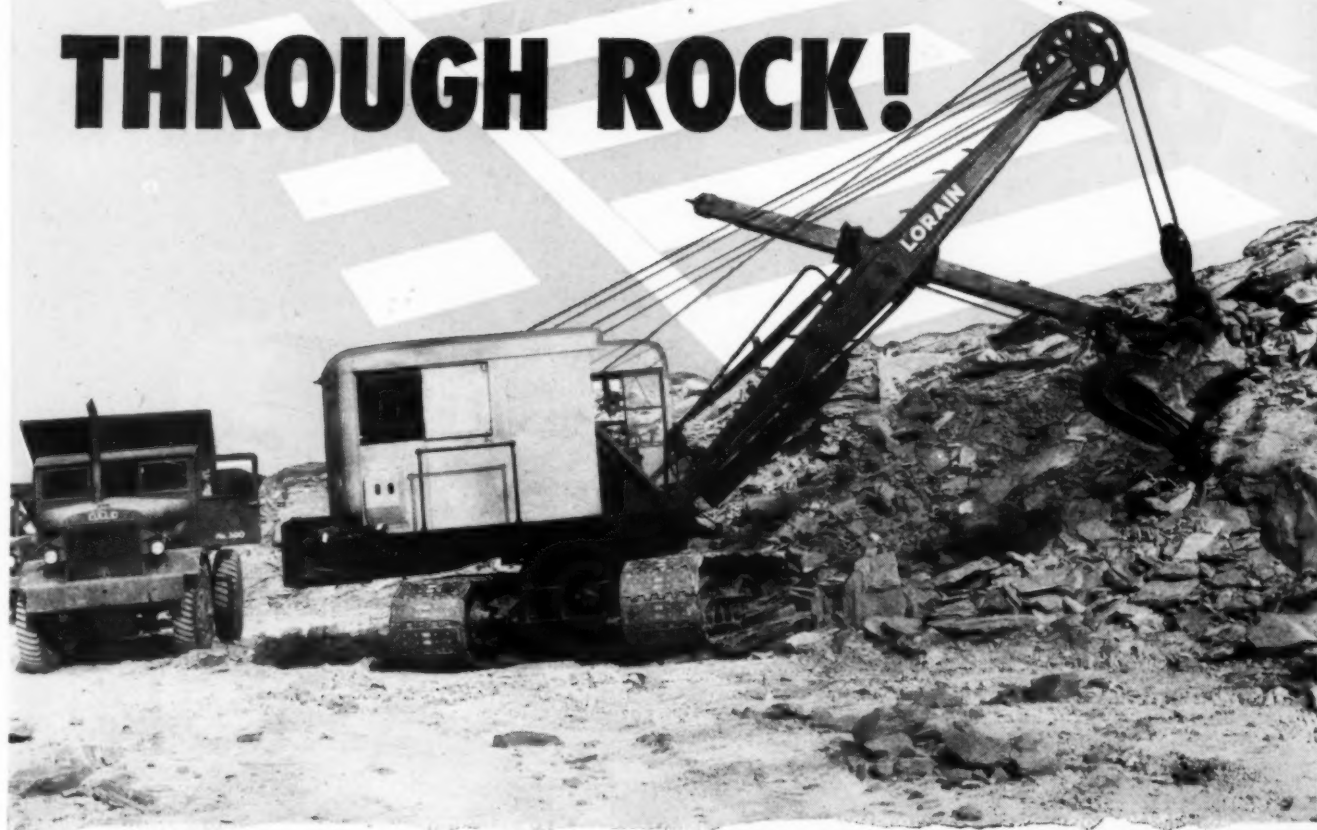
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RAILROADIN' THROUGH ROCK!



THERE'S 1,500,000 yards of excavation on this railroad relocation contract and a good portion of it consists of tough limestone rock. Spearheading the job is this 2-yd. Lorain-820 shovel.

Why is the 2-yd. Lorain-820 a regular on the rock jobs? First, and foremost, because of its Hydraulic Clutch which (1) absorbs "rock shock" before its destructive action can reach mechanism and cables and (2) improves "hanging on" performance to the point where you can't stall the engine.

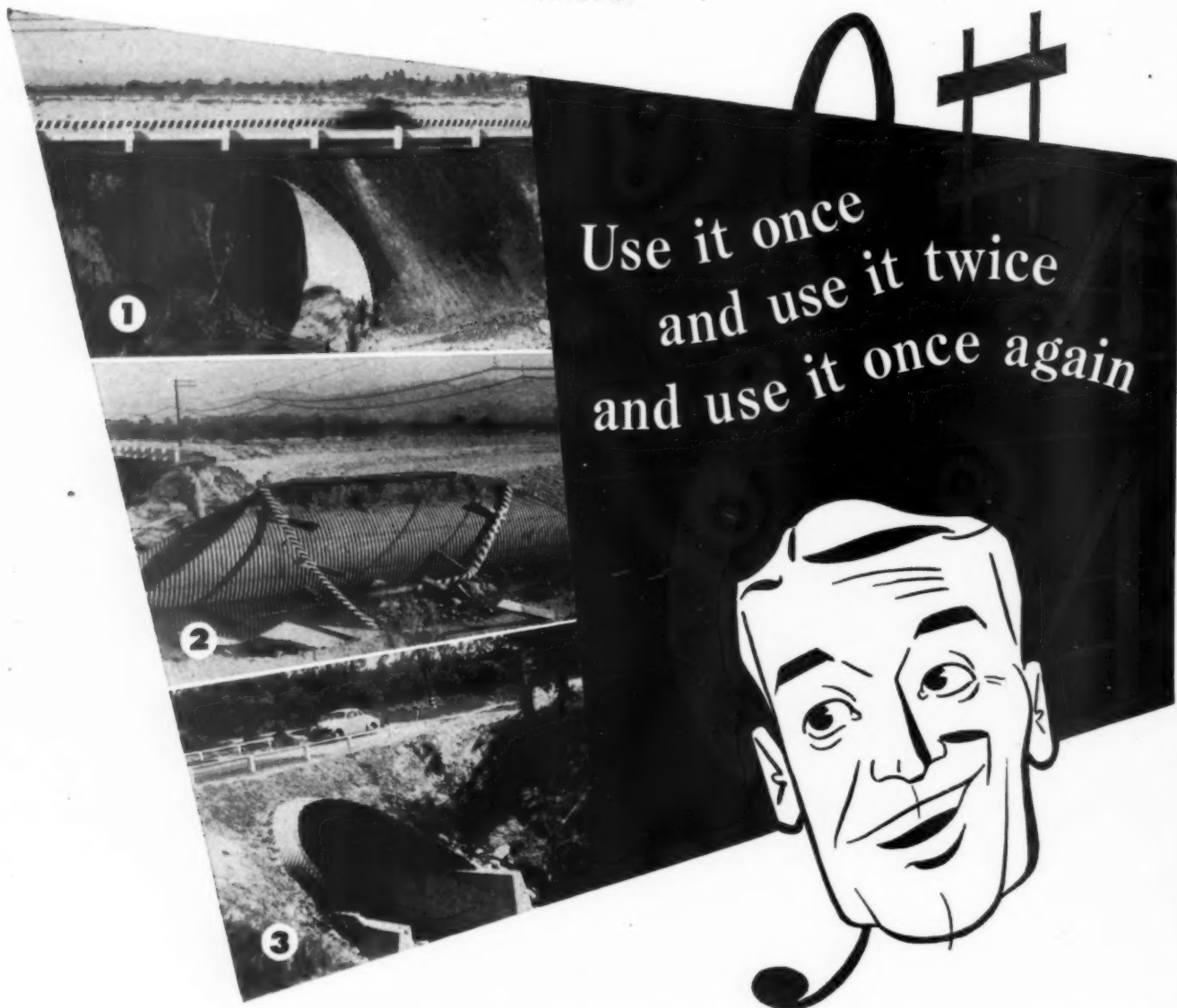
Add to this Thew pioneered feature the extra power of double Center Drive design on the turntable, the strength of an all-welded shovel boom and dipper stick and the stability and mobility of a big 2-speed chain drive crawler 15 ft., 6 in. long. Result? A fighting combination that has won every round against rock on many of the nation's toughest jobs.

Your local Thew-Lorain distributor can supply you complete information on this 2-yd. shovel. Write or call him today!

Reg. Trade Mark
thew-Lorain

THE
THEW SHOVEL CO.
Lorain, Ohio

CRANES • SHOVELS • DRAGLINES • MOTO-CRANES



1 Original ARMCO Multi Plate installation—13 1/4 feet in diameter and 75 feet long.

2 This is what happened when a sudden flood washed out the road. The ARMCO Multi Plate structure was intact but was replaced by a bridge with greater flood capacity.

3 Making little bridges out of a big bridge was easy with ARMCO Multi Plate. Sections from the original structure were used in building this one. The same mitering was used at the ends without recutting. Two other arches, 7 feet in span and 40 feet long, were also constructed and enough plates were left for still another small bridge when needed.

Multi Plate can be salvaged 100%

There's a song in every budget when you can offset disaster as easily as this experience shows.

When an unprecedented flood washed out a Multi Plate bridge it was replaced by a larger structure. Yet material loss was zero since the sturdy Multi Plate sections were salvaged and used to build several smaller bridges at other locations.

"Packaged" Multi Plate structures are "budget-savers" from start to finish. The easily-handled, pre-curved, corrugated plates are nested together to save space in shipping, hauling and storing. Construction is done with unskilled labor, the simplest equipment and small tools. No curing, no waste, no delay. The road is quickly opened to traffic—often without detours.

For a durable, economical job include ARMCO Multi Plate in your plans for bridges, stream enclosures, large sewers and special drainage structures. Then you'll never have to worry about being left "high and dry" should conditions change. Write today for complete data. Armco Drainage & Metal Products, Inc., 1385 Curtis Street, Middletown, Ohio



ARMCO Multi Plate

NORTHWEST

*Still
the
Standard*

The entire attention of the Northwest Engineering Department has been devoted to the design, improvement and production of Shovels, Cranes, Draglines and Pullshovels—machines definitely related to each other.

In conversations with contractors, engineers, highway department men and other equipment salesmen, you will find that these machines have become standards of comparison wherever you go. This is just one of the many things that have made one out of every three Northwests a repeat order.

**NORTHWEST
ENGINEERING COMPANY**
1732 Steger Building
28 E. Jackson Blvd., Chicago 4, Ill.

**...TOWARD
WHICH OTHERS
BUILD!**

*-and
when you have
a real Rock Shovel
you won't have
to worry about
output in dirt*

Follow the Northwest crowd!

NORTHWEST

SHOVELS • CRANES • DRAGLINES • PULLSHOVELS

3 **TOURNAPULLS** *grade.* *spread sub-base.*



Rigs spread 5" sub-base in two 4 1/2" lifts. Positive cable control insures accurate spread.

... Stanley H. Arkwright, Inc. of Billings, Montana, took advantage of Tournapull speed and versatility on U.S. 10 between Billings and Huntley

Relocation included 386,000 cubic yards of grading in clay, sand, loam, gravel and blasted rock, all moved with LeTourneau equipment. Hauls ranged from 600 to 4000'.

11 Trips per hour on 1500' 1-way haul

On grading, each Tournapull, loading dry sandy clay, made 11 trips per hour, averaged 10 1/2 to

11 pay yards per load, delivered better than 115 pay yards per hour. Part of haul was tough going . . . over a fresh fill on a spongy alkali bog.

Tournapulls spread 45,000 yards sub-base . . . hauls to 2.2 miles

As each section of grading was finished, Arkwright's rigs quickly stripped overburden from

Arkwright's Tournapulls stripped roadside pits . . . loaded out select sub-base gravel.



Big-load capacity, high-speed travel kept cost per yard down on hauls from pits up to 2.2 miles one way.



LETOURNEAU
PEORIA, ILLINOIS

JOB-PROVED
Over 4600 Built and Shipped

TOURNAPULLS

le. strip gravel pits . . . e. ON MONTANA ROAD JOB



10.5 to 11 pay yards of sandy clay were loaded down 2.8% grade in 125' in an average 1:20 minutes.

centrally located roadside gravel deposits, then spread 9" sub-base on the roadbed. Operators used controlled ejection with patented tailgate, plus finishing action of Scraper blade to spread in smooth accurate 4½" lifts, cut finishing time to a minimum. On hauls averaging 6100' one way over 2% adverse grade . . . each Tournapull rig averaged 38 pay yards per hour.

You, too, will find Tournapulls' high speed on both long and short hauls, plus job versatility for grading, stripping and graveling, will deliver lowest-net-cost-per-yard for you. Ask your LeTourneau Distributor for facts and figures.

Tournapulls spread grading material in smooth even layers. Big tires help compact fill.



On grading operation, each Tournapull hauled 115 pay yards per hour on 3000' round trips.



• FOR LOWEST

NET COST PER YARD

Here are 1050 MEN shoveling snow



... That's the Manpower of a *Bros* Rotary

Every minute the *Bros* Rotary does a snow removal job it equals 1050 men working with shovels. The NEW *Bros* Sno-Flyer puts more snow into the haul-away trucks because it delivers the snow with greater velocity and really packs it in. That's economical snow loading. It's the type of work that enables the *Bros* to pay for itself within a short time.

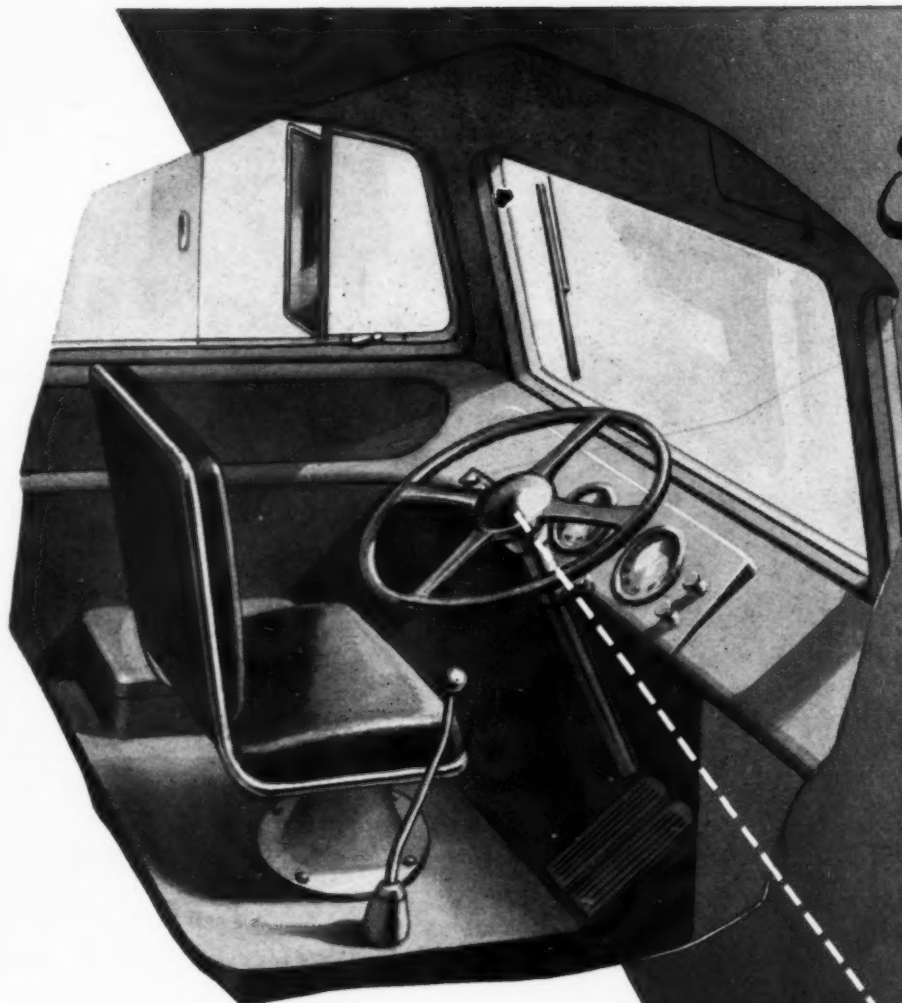
The forward and vertical action of the exclusive *Bros* feeding rake delivers the snow to dual discharge

rotors which have a casting range of 150 feet on airport and highway work. The same power can be utilized with a capped chute for shorter casting distance or loading work. The casting capacity of the 170 h.p. unit is up to 42 tons per minute of fresh-fallen snow while the 275 h.p. unit rates up to 51 tons per minute.

Write for further details. Wm. Bros Boiler and Manufacturing Company, Minneapolis 14, Minn.

BRÖS

MANUFACTURERS OF THE FASTEST AND MOST POWERFUL ROTARY PLOWS



*Steering
Comfort
Too*

**IS NEEDED
IN HEAVY
VEHICLES**

**GEMMER
STEERING**

Practically frictionless, Gemmer Steering provides comfort in steering, which is so important in heavy vehicles—

Important, because an overtired driver can't work as fast— isn't as safe—doesn't do the job as well—as one who is protected against serious fatigue. Comfort pays in work done and in greater safety. More people steer the Gemmer way than any other. Gemmer pioneered easy steering for all types of vehicles, with the gear teeth that roll—liberal use of antifriction bearings.

The design is inherently sturdy—stable—banishes lost motion—reduces wear to least possible minimum. Steering is always firm responsive, positive, with absence of rubbery feeling or wander. Compactness provides easy installation—saving of weight without sacrifice of overall capacity or steering arm angularity. A Gemmer Steering Gear with Reasonable Care Should Last and Give Satisfaction for the Life of the Vehicle.



STEER THE GEMMER WAY

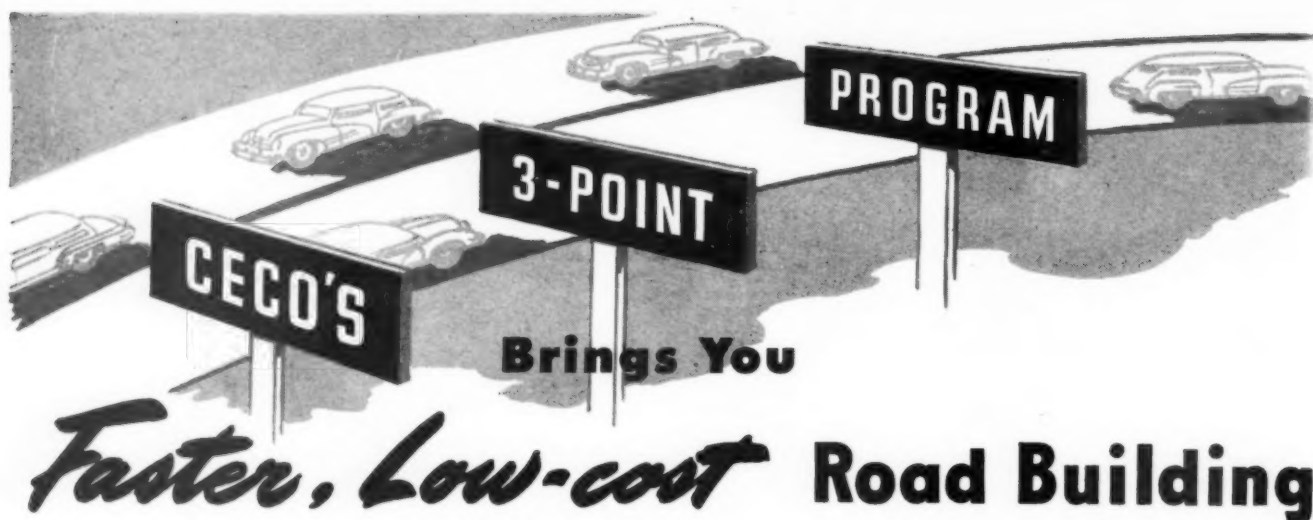
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2 You can cut down detail work when you deal with Ceko. They supply all data on reinforcing and other highway materials.

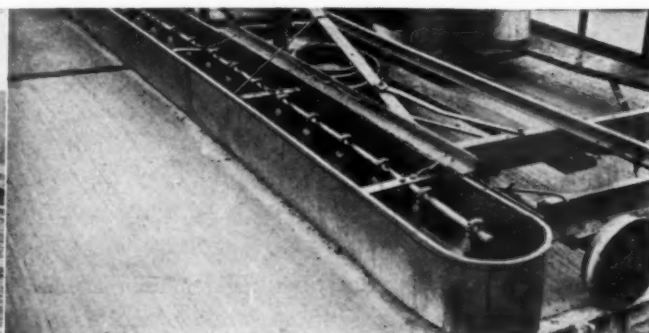
3 You can depend on Ceko for a streamlined operation. In one complete order, Ceko gets materials to you as you require it.

CECO ENGINEERING + CONSTRUCTION EXPERIENCE HELPS YOU SOLVE ROAD BUILDING PROBLEMS

Ceko offers you more than precision road building materials. It offers you all the wealth of construction knowledge resulting from years of practical experience. Call any one of 23 offices strategically located coast to coast. Yes, call on Ceko for engineering skill and the finest in construction products.



Welded Fabric, electrically welded at intersections, makes ideal reinforcing.



Cecure Applicator gives positive, even application of Cecure compound.

Typical Ceko Highway Products

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and Applicators
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CECO STEEL PRODUCTS CORPORATION

GENERAL OFFICES

5701 WEST 26TH ST., CHICAGO 50, ILL.

In construction products **CECO ENGINEERING** *makes the big difference*

RUGGED IS RIGHT!

7½ YEARS YOUNG . . .
AND STILL ON THE JOB!

Five Allis-Chalmers HD-14's — Pennsylvania Turnpike veterans — owned by Fox Valley Construction Company, Appleton, Wisconsin, have been in continuous operation on tough work since June, 1939. Not until December, 1944 — 5½ YEARS LATER — was a major overhaul necessary! Now they are hurrying construction of U. S. Highway 8 in Rusk and Price counties, Wisconsin. This Is Rugged Tractor Power!

DOWN GOES A TOUGH SHALE CUT . . . QUICK!

Here eight hard-hitting Allis-Chalmers HD-14's with scrapers and bulldozers demonstrate their power and stamina on G. H. Yoxtheimer's tough stripping operation near Punxsutawney, Pennsylvania. Tough clay and shale are the materials . . . yet scrapers are heaped, bulldozer blades filled!

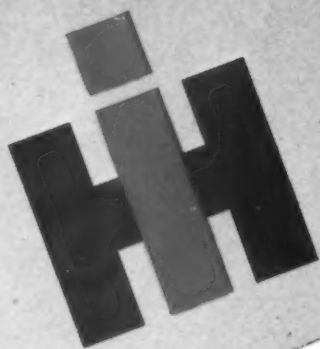
This is the kind of ruggedness that enables you to move the toughest materials and still put in a higher percentage of working time on the job. In addition, with 2-cycle Diesel power, exclusive in Allis-Chalmers tractors, you start instantly on Diesel fuel, maneuver easier, move more yards every working hour. Yes, Allis-Chalmers 2-Cycle Diesel Tractors Are Rugged — Rugged and Fast!



ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

FAST, RUGGED! . . .

THAT'S A-C 2-CYCLE DIESEL
TRACTOR POWER!



Presents

More Power Greater Hang-on Better Operating Economy

More Power! The horsepower of two models of International Diesel Power Units has been stepped up by 11% and 25% respectively — without increasing their size or weight — as the result of advanced engineering in the fuel combustion system. These are the 4-cylinder, 76-hp. UD-14A and 6-cylinder 125-hp. UD-18A Power Units. Power ratings are for *working* horsepower of the complete unit with fan, radiator and power take-off.

Greater Hang-on! When pulled down by overload, increased torque gives these Diesels greater "lug-ability." And they are built to take overloads in stride!

Better Operating Economy! Even with horsepower stepped up, these Diesels run cool under heavy loads and operate at new low cost per horsepower. A low rate of fuel consumption proves their efficiency.

Available Soon! Look for these newest International Diesels in the powered equipment soon available through your International Industrial Power Distributor. And ask him for the facts and figures on these models. He has them now.

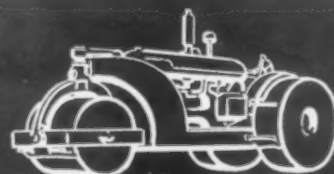
Industrial Power Division

INTERNATIONAL HARVESTER COMPANY

180 North Michigan Avenue



Chicago 1, Illinois



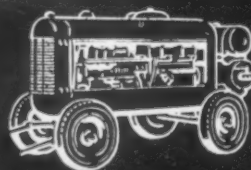
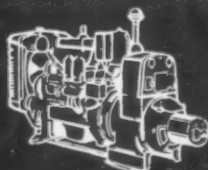
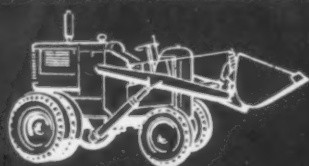
Another Advance in INTERNATIONAL DIESEL POWER



← The UD-14A Diesel Power Unit delivers 76 horsepower at 1400 governed r.p.m.

The UD-18A Diesel Power Unit delivers 125 horsepower at 1600 governed r.p.m. →

INTERNATIONAL Industrial Power



FUEL-THRIFTY COMPRESSOR



meets air demands exactly

This CP-500 Diesel-driven portable air compressor delivers 500 cubic feet of air a minute when it is needed. But whenever the air demand slackens, the engine speed does likewise.

This is because the CP Gradual Speed Regulator automatically synchronizes the engine speed to variations in air demand. The engine never runs at any speed higher than required,

avoiding fuel wastage and minimizing maintenance.

CP-500 is one of a line of CP Portable Compressors, available in gasoline powered models of 60, 105, 160, 210 and 315 C.F.M. and in Diesel-powered models of 105, 160, 210, 315 and 500 C.F.M.

Write for further information.

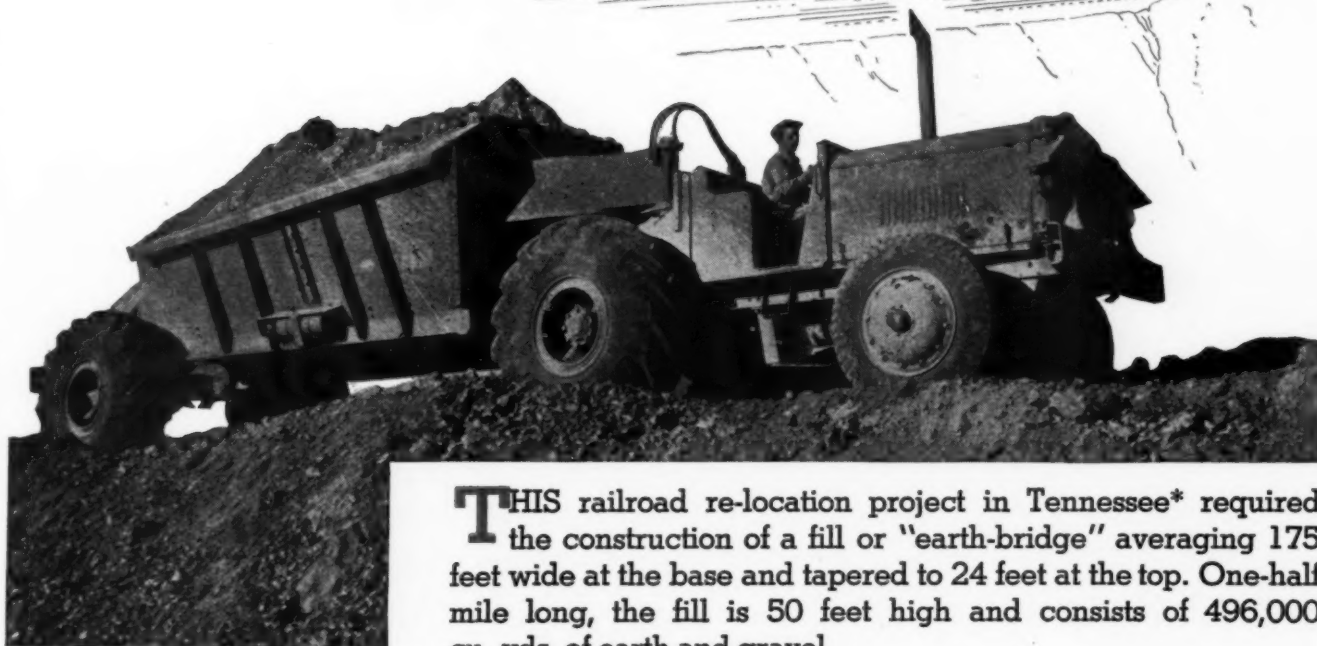


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General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
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EUCLIDS Build "EARTH BRIDGE" across valley



★ BOTTOM-DUMP EUCLID ADVANTAGES



**FASTER
TURNING**

Sturdy, universal trailer hitch with ample clearance for hopper and doors.



**QUICKER
DUMPING**

Steep, smooth sides of the trailer and unobstructed door openings full length and width — control for opening and closing the doors is conveniently located on the steering column.

THIS railroad re-location project in Tennessee* required the construction of a fill or "earth-bridge" averaging 175 feet wide at the base and tapered to 24 feet at the top. One-half mile long, the fill is 50 feet high and consists of 496,000 cu. yds. of earth and gravel.

The Wolfe-Michael Co. used five Bottom-Dump Euclids of 13 yd. capacity which were loaded by a $1\frac{3}{4}$ cu. yd. shovel. Average speed of the Euclids for the 7,040 ft. haul was 12.5 m.p.h. including turns on fill and at the loading shovel.

Exceptional maneuverability and short turning radius of the Bottom-Dump Euclids were important on this job because of the close working quarters and narrow fill. Fast travel speed on the difficult haul road and the ability of Euclids to dump their loads quickly saved time and reduced hauling costs.

All Euclid models, Rear-Dump and Bottom-Dump, are designed and constructed for a single purpose — to move earth and other materials over off-the-highway hauls at lowest cost. Your Euclid distributor will be glad to provide information and specifications on the models best suited to your requirements.

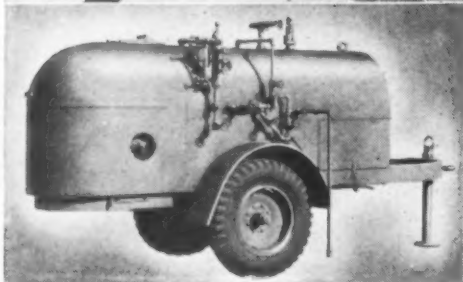
*Part of the improvement program of the Nashville, Chattanooga and St. Louis R. R. near Dickson, Tennessee, west of Nashville.

The EUCLID ROAD MACHINERY Co., CLEVELAND 17, OHIO

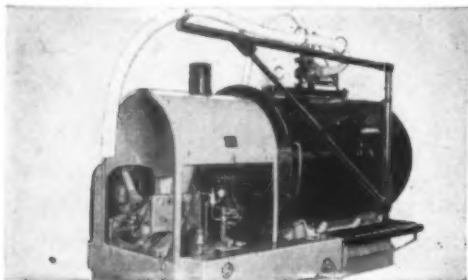


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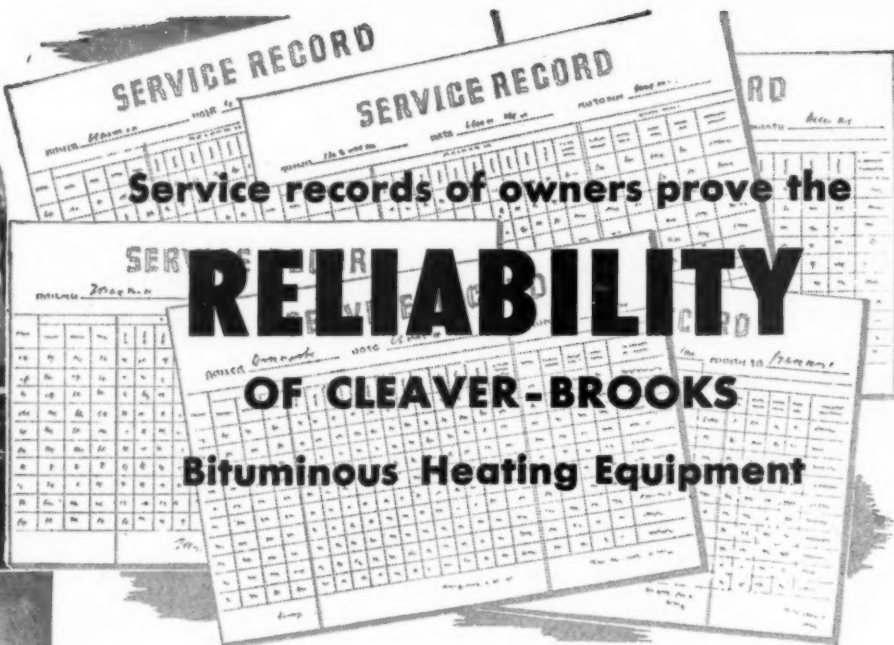
Mobile tank-car heater available in two and three tank-car sizes. Oil-fired with exclusive design four-pass flue travel; dry-coil steam condensate return under pressure—no water or heat loss.



Portable pumping booster. Heats by direct firing in one operation, loading directly to distributor, relay truck or returning to tank-car. Available in 2 sizes—truck mounting or 4 wheel trailer.



Truck mounted pumping booster in service of Oklahoma Bituminous Distributing Co., Ada, Okla.



Service records of owners prove the

RELIABILITY

OF CLEAVER-BROOKS

Bituminous Heating Equipment

- ★ Most of the pioneer models of tank-car heaters, built by Cleaver-Brooks sixteen years ago, are still in service.
- ★ There are more Cleaver-Brooks tank car heaters and bituminous boosters in service than all other makes of similar equipment combined.
- ★ Service records from hundreds of owners prove Cleaver-Brooks dependability and durability. Cleaver-Brooks equipment is usually assigned to the difficult jobs—the hardest jobs—because of its known capacity and reliability.
- ★ The design and construction of Cleaver-Brooks heating equipment is subject to constant check—to include every feature that contributes to the most effective performance and long service life.
- ★ Cleaver-Brooks heaters are the “finished” product of the pioneers and originators of tank-car heaters and bituminous boosters—built by specialists in the construction of portable and stationary steam generators.

On your next bituminous heating equipment purchase you can expect to get more value from Cleaver-Brooks—qualified by experience and facilities in this specialized field.

CLEAVER-BROOKS COMPANY

5106 N. 33rd St.

Milwaukee 9, Wis.

Cleaver-Brooks

PIONEERS AND
ORIGINATORS OF

TANK CAR HEATERS . . . BITUMINOUS BOOSTERS . . . AUTOMATIC STEAM-PLANTS



So what about this tire?

IT'S ROUGH!

This FIRESTONE GROUND GRIP TIRE has carried tens of thousands of cubic yards of dirt over the rockiest haul roads to be found in the western Mountain States. No down time has ever been charged against this tire.

IT'S TOUGH!

Those massive tread bars have absorbed the most grueling punishment a tire can be asked to take, have protected the body from blows and cuts. Double thick sidewalls have resisted snagging, cutting and rutwear.

IT'S READY FOR MORE!

This FIRESTONE GROUND GRIP, having already delivered many more hours of service than normally expected on this type of operation, is ready to roll — will carry many more thousands of tons of payload.

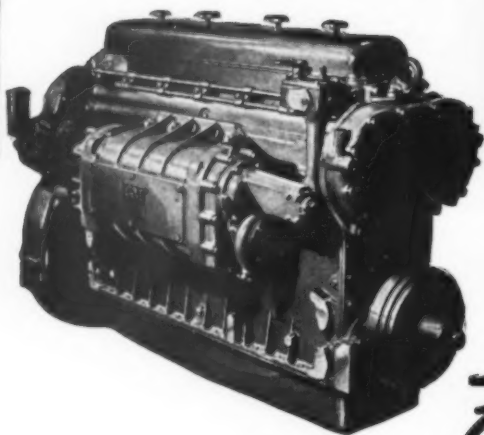
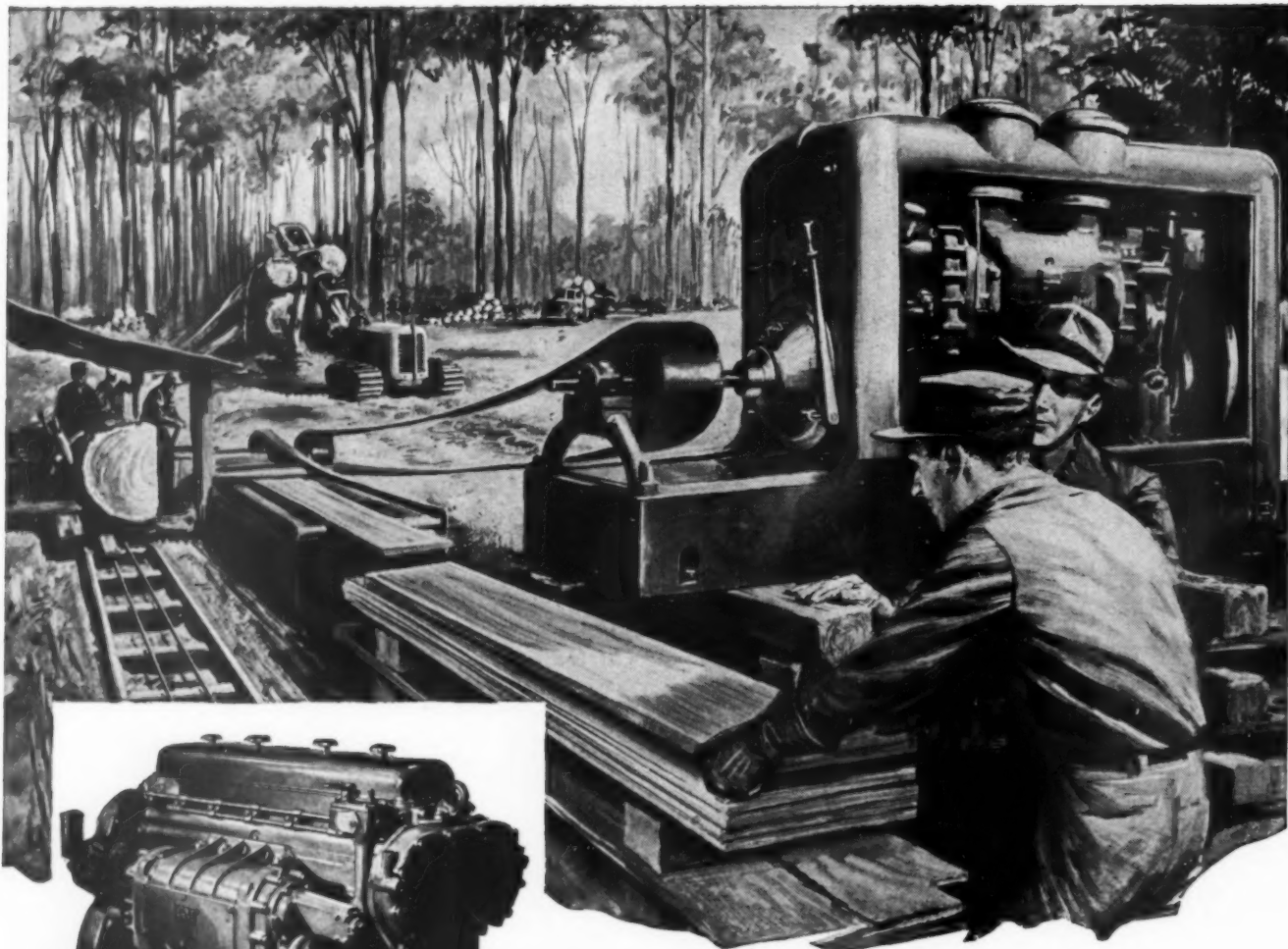
Firestone
OFF-THE-HIGHWAY TIRES



GROUND GRIP ROCK GRIP EARTH MOVER

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For Great Diesel Power
take a look at Lumbering

THROUGHOUT the lumber industry a new kind of power is taking over. It is flexible power that can operate the whole mill—can drive pond drag, head saw, edger, trimmer, cut-off saw, conveyor and what-have-you. It is economical power—makes fuel costs next to negligible. It is sturdy power—responds immediately to increased loads. It is portable power—moveable to the next job with little fuss.

In short it is Series 71 General Motors Diesel power.

GM Diesels are 2-cycle. That makes them compact as well as powerful. They have clean design, unit injectors and Uniflow

scavenging—making them clean-burning, efficient and easy to take care of.

These features make GM Diesels important to any industry.

* * *

So whatever needs for power you may have in road-making machinery, crushers, shovels or any other construction equipment—look to GM Diesels.



DETROIT DIESEL ENGINE DIVISION

DETROIT 23, MICH. • SINGLE ENGINES... Up to 200 H.P.
MULTIPLE UNITS... Up to 800 H.P.
GENERAL MOTORS

Features of GM Diesels Important to Every User of Power

QUICK TO START—on their own fuel

ECONOMICAL—run on low cost fuel

EASY TO MAINTAIN—clean design plus accessibility

LESS FIRE HAZARD—no volatile explosive fuel

COMPACT—readily adaptable to any installation

SMOOTH OPERATION—rotating and reciprocating forces completely balanced

QUICK ACCELERATION—2-cycle principle produces power with every downward piston stroke



UNIT 357

— 5 ton Self-Propelled Mobile Crane on sign erection job. Operated by one man... powered by one engine.

UNIT 1020

— $\frac{3}{4}$ yard Dragline used on large drainage project. Full revolving. Finger-tip controls from FULL VISION cab.

UNIT 1020

— $\frac{3}{4}$ yard Crawler-type Shovel taking a deep bite on a basement digging job. Assures maximum yardage profits.

UNIT 357

— $\frac{1}{2}$ yard Mobile Trencher. Modern, self-propelled excavator. Rides on rubber. Operated by one man. Fully convertible.

Let UNIT Carry the Ball



When you "go into a huddle" to select that next crane or shovel, be sure to consider UNIT. You'll find that every UNIT has the power and stamina to "carry the ball" through to victory. Excavators that move fast... bite deep and hard. Cranes with plenty of LIFT ability. Exclusive features include Automatic traction brakes... Straight line engine mounting... One piece cast gear case... Disc type clutches... and above all, UNIT'S safety-promoting FULL VISION CAB. Rugged... well-balanced... always dependable in the pinches... UNIT will help you reach your profit goal. Available in $\frac{1}{2}$ and $\frac{3}{4}$ yard excavators... 5 and 10 ton cranes... Fully convertible to ALL attachments. Write for literature.

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5 and 10 TON CRANES

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NEW!



Lower Cost Hauling up to 20 Tons
"G. T. W."

DODGE *"Job-Rated"* HEAVY-DUTY TRUCKS

WITH NEW 282 AND 331 CUBIC INCH POWER PLANTS—ENGINEERED TO SET NEW POWER AND ECONOMY STANDARDS!

We sincerely believe you'll find these great *new* Dodge "*Job-Rated*" 'heavyweights' the most *profitable* trucks you can operate for loads up to 20 tons (G.T.W.).

They're powered by two brilliant *truck* engines—of 282 and 331 cubic inch displacement—in which horsepower-to-weight ratios reach a new high!

These engines develop 225 and 270 pound-feet of torque respectively—and maintain a high torque output over a wide range of engine revolutions.

Engine cylinder walls, of chrome nickel molybdenum alloy cast iron, are *so hard* that wear is almost non-existent. Every valve is made of silchrome, one of the hardest metals known. Exhaust valves are sodium-cooled, and valves and valve seat inserts are stellite-faced.

Everywhere, unnecessary surplus weight is eliminated by improved design and advanced metallurgy. New and strictly *heavy-duty* clutches, and a remarkably efficient five-speed transmission—coupled with rear axles of entirely new design—provide a highly efficient transmission of driving torque to the wheels.

Despite their husky construction and rugged, brute strength—these trucks handle with remarkable ease. It's a "cinch" to keep them rolling—even on steep grades with capacity loads.

If *your* transportation requirements fall within the 18,500 to 23,000-pound gross vehicle weight ranges (up to 40,000 pounds G.T.W.) . . . by all means get the *complete* story of these great new Dodge "*Job-Rated*" heavy-duty trucks. We believe you'll find them your long-awaited answer to *lower-cost* hauling in their capacity ranges!

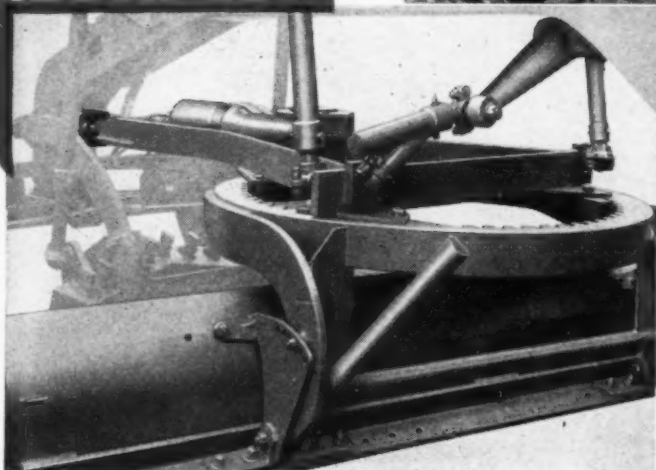
ONLY DODGE BUILDS "*Job-Rated*" TRUCKS!

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You can easily
"MAKE THE GRADE"
with a
GALION
102
MOTOR
GRADER

THE
SECRET OF A
MOOTH CUT



Moldboard, circle, drawbars, and connection to head block on the GALION 102 are noted for their exceptionally rugged construction and rigid assembly.

Ball and socket connection to head block permits the whole assembly to be freely pivoted, yet sturdily anchored. Adjustable for wear.

The circle is supported by four heavy "shoes". These shoes have two-way adjustment to eliminate looseness and "chattering".

Welded tubular braces give added strength to the circle knees.

Powerful hydraulic motors, under finger-tip control of operator, assure fast and accurate positioning of blade.

It helps you to really shape that road right up to specifications—with a minimum of work. The economical performance of the GALION 102 will lower your costs—enabling you to "make the grade" on an increasing number of jobs.

A prime factor in this economical performance lies in GALION'S hydraulically operated blade lift, circle reverse and side shift, plus the narrow, high-arched, box-type frame. The design permits quick and exact adjustment of blade to each specific job—whether for ordinary blading or high bank cutting.

It will pay you to get the facts on the GALION 102—write for a copy of Catalog No. 290 today.

The GALION IRON WORKS & MFG. CO.

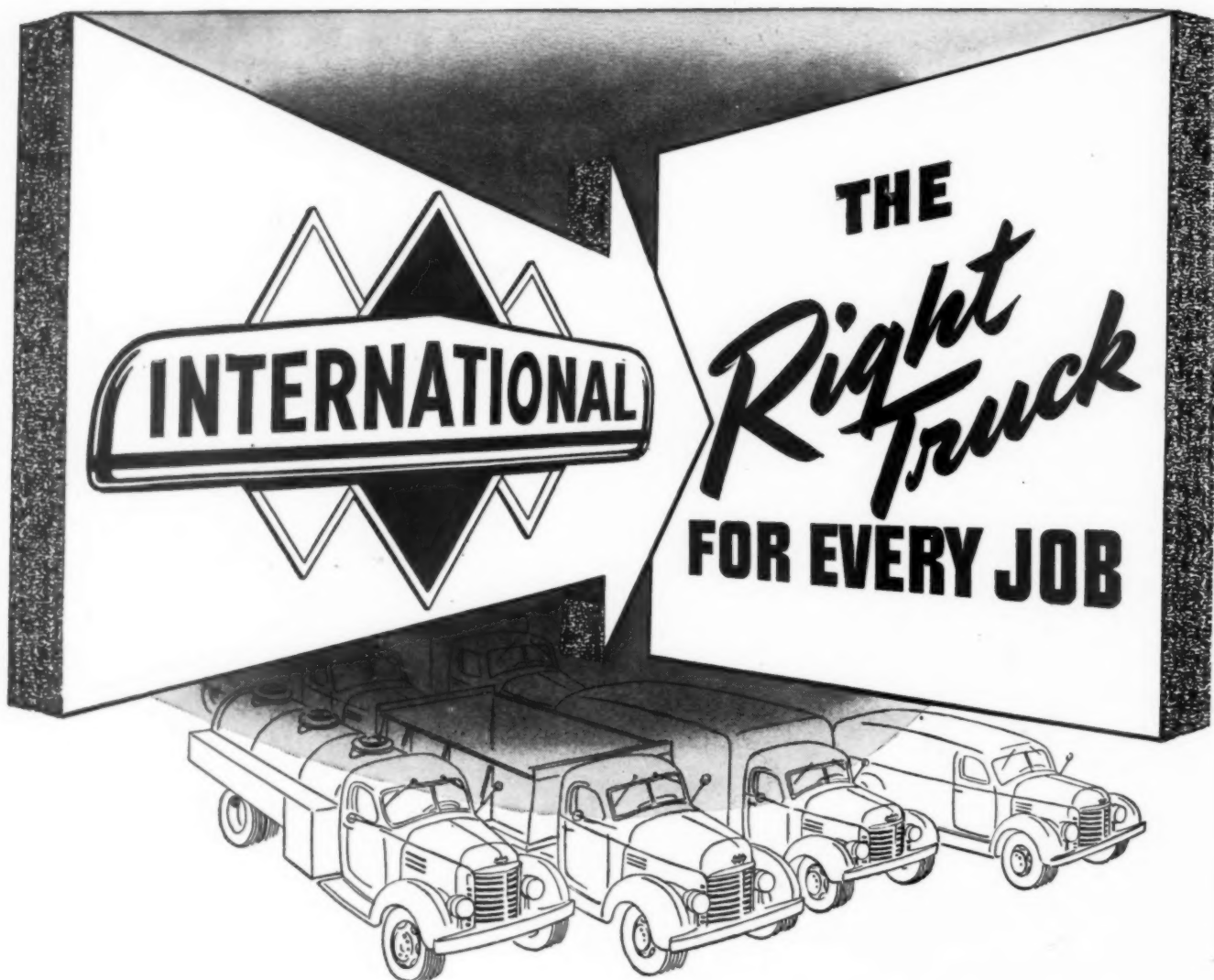
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Galion, Ohio, U. S. A.

GALION FEATURES THAT ASSURE TOP PERFORMANCE

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3. Rugged box type main frame.
4. Gear type, four-wheel tandem drive.
5. Full hydraulic control—low pressure system.
6. Heavy front axle construction.
7. Blade pressure of 13,500 pounds.
8. Powerful full Diesel motor.

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Consider this overwhelming evidence of International Truck performance:

Every year for the last 15, American commerce and industry have purchased more heavy-duty Internationals than any other make.

And consider the service facilities that back International Trucks—specialized truck service,

furnished by experts trained in every detail of economical truck operation.

This service is supplied by the nation's largest company-owned truck service organization—International Branches—and by International Dealers everywhere.

Yes, there's an International—the *right* International—for every truck job, backed by the nation's outstanding truck-service facilities.

Motor Truck Division

INTERNATIONAL HARVESTER COMPANY

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See newspapers for time and station.*



INTERNATIONAL Trucks

**AIR
PLUS**

JAEGER COMPRESSOR

picked for the **tough air jobs**

Have you noticed the high number of "AIR PLUS" Compressors on the jobs where you meet rough going and there's constant heavy need for air?

Contractors know that Jaeger builds for that kind of service — with 75% to 100% bigger, cooler valves that operate indefinitely without carbon, with 20% to 30% slower, long-life piston speeds (800 f.p.m.), with full force feed lubrication, lifetime clutches, and interchangeable precision parts. They know that Jaeger standardizes on dependable Caterpillar and International diesels and Continental gasoline power. They know that engine and compressor will safely trail wherever a truck can travel, protected by the most rigid frame and roadable mounting ever put beneath a portable compressor.

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"FLEET-FOOT"
Loaders



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less of season or weather. That's a great convenience and a saving for plant, contractor and customer. Only the KOTAL Process makes this possible.

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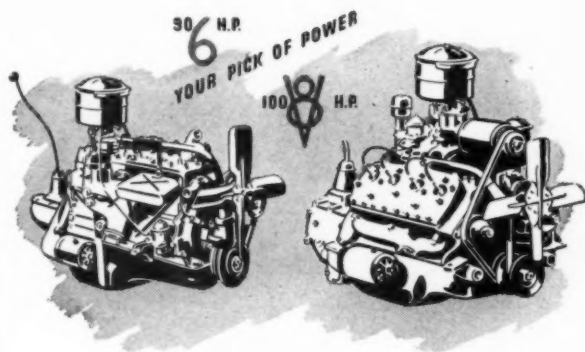
"FORD TRUCKS LAST LONGER!"



*Ford Heavy Duty unit, with
Thornton rear axle drive and 6-
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Metal Products Co., Marion, O.*



One big reason— **FORD ENGINES STAND UP!**



Ford Truck engines—either the famous 100-H.P. V-8 or the extra-thrifty 90-H.P. Six—are world-famous for endurance in severe service. Here are some reasons why: They're of time-proved L-head type, quiet, simple, efficient—hardened valve seat inserts resist pounding and pitting—precision-set valves need no adjusting—valve springs are shot-peened and rust-proofed for long life—Ford alloy cast steel crankshafts are balanced and counterbalanced for enduring smoothness—Flightlight aluminum alloy 4-ring pistons maintain good compression, save oil. Full pressure lubrication, with positive, large-capacity oil pumps, plus effective crankcase ventilation, scientifically correct cooling and efficient oil- and air-filtering, all prolong Ford engine life.

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registered since 1928 are still in service—why more than half of all Ford Trucks on the job are at least nine years old!

The best way to get a new Ford Truck is to get your order in. See your Ford Dealer now.

FORD TRUCKS

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When writing advertisers please mention —> **ROADS AND STREETS, November, 1946**

THIS No. 101 UNIT IS PACKED FULL OF UTILITY

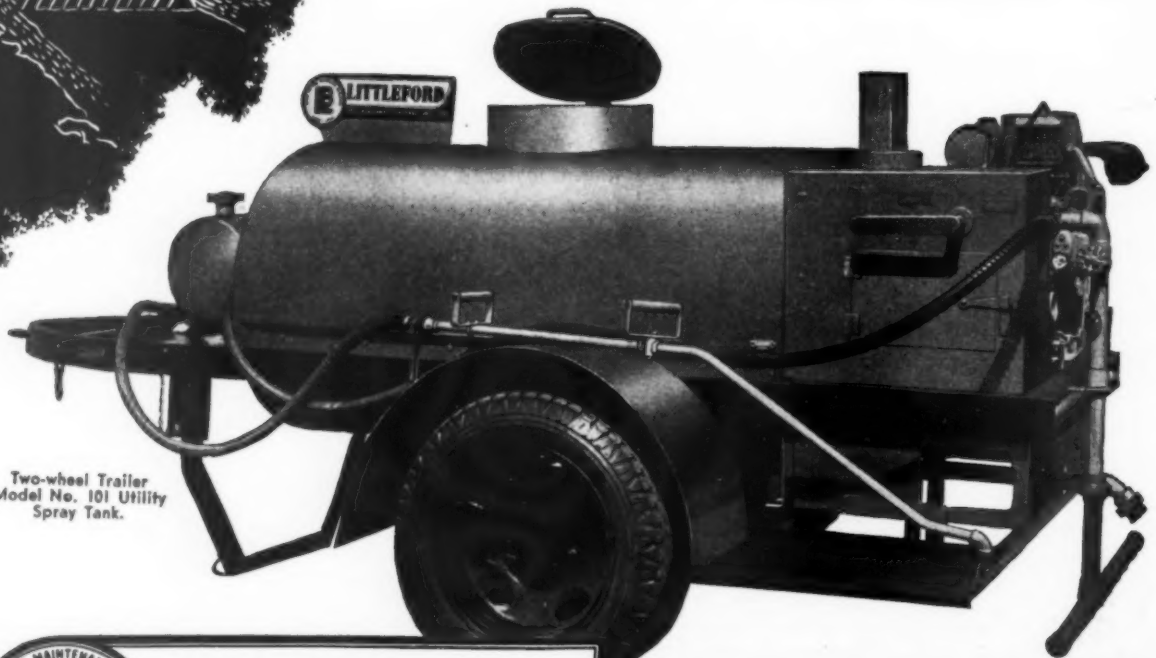


Truck mounted No. 101 using Hand Spray Attachment.



When those Streets, Roads or Airport Runways need repair, the Littleford Model No. 101 Utility Spray Tank is just the unit for the job. It's a combination of three units in one—has Spray Bar for small application work, Hand Spray for patch work and a Pouring Pot Outlet for crack filling work.

No. 101 will handle Asphalt, Tar, Cut-Back, Road Oils and Emulsions. For real *Utility* be sure to use a Littleford No. 101 Utility Spray Tank.



Two-wheel Trailer Model No. 101 Utility Spray Tank.



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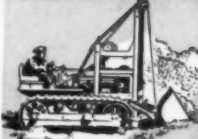
LITTLEFORD BROS., Inc.

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Work is the word for TRAXCAVATORS! On roads and street construction and maintenance, these rugged, multi-purpose machines save time, labor and money because they do more work on more jobs at lower cost. Some samples of TRAXCAVATOR versatility are pictured here: — two views of a Model T7 ripping up and loading old concrete pavement, curb and sidewalk; also, an IT4 grading for new paving on a road-widening project in New Jersey. Preparing subgrades, clearing right-of-way, charging crushers and mixers, hauling and other earth-moving and material-handling jobs are also made to order for TRAXCAVATORS. They're one-machine gangs on any road or street job.

TRAXCAVATORS are built in several models, a size for every job and purpose—with bucket capacities from $\frac{1}{2}$ to $2\frac{1}{2}$ cubic yards. See your TRACKSON-“Caterpillar” dealer, or write to TRACKSON COMPANY, Dept. RS-116, Milwaukee 1, Wisconsin.




DIGS
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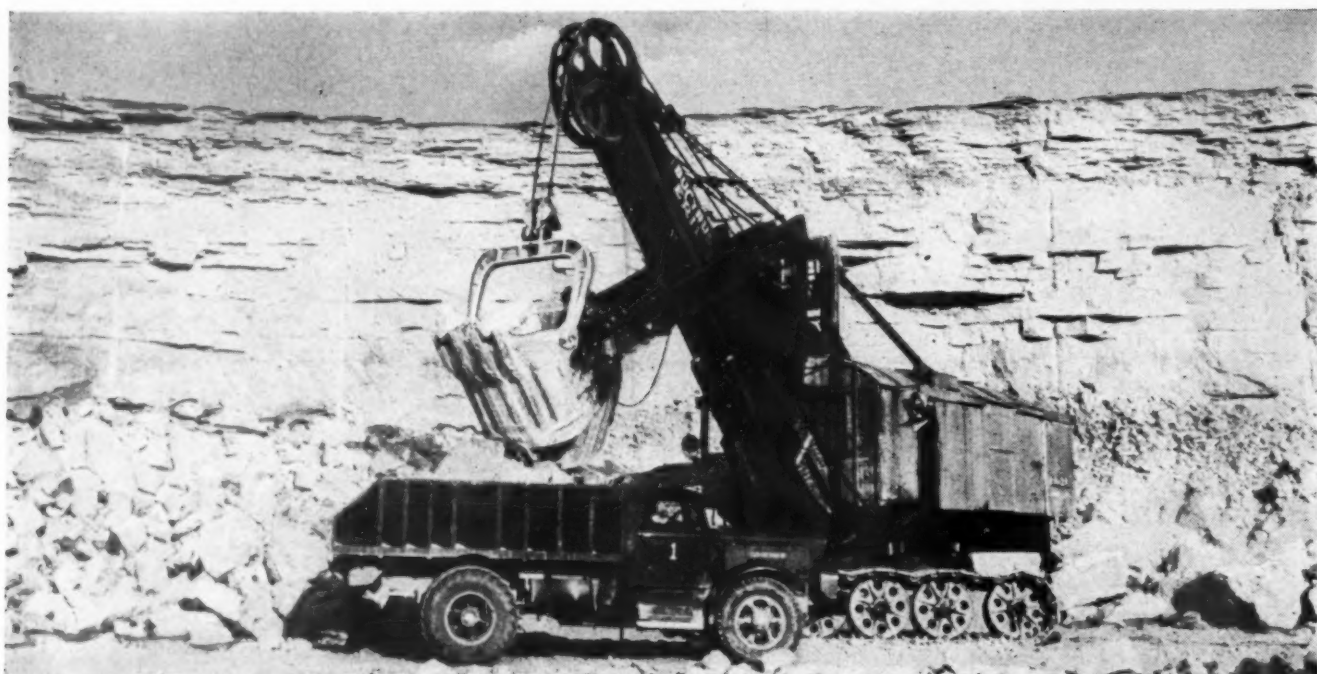
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THE ORIGINAL TRACTOR EXCAVATOR



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All Point Efficiency with **SINCLAIR** **SPECIALIZED LUBRICANTS**



CONTINUOUS efficient operation demands no failure of any mechanical part. Good engine lubrication is not enough. Proper ALL-POINT protection is vital. Sinclair lubricants are designed for specific service at every individual point.

For engines . . . Opaline Motor Oil and Opaline TBT Motor Oil provide sure, safe lubrication. Sinclair Tenol for carbon-resistant Diesel lubrication.

For gears . . . Opaline Gear Lubricant provides extreme pressure properties to prevent galling and scuffing. It resists

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Try these specialized lubricants for efficient, economical operation of each important mechanical service.

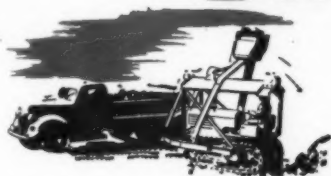
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FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.



Boring transmission case to close tolerances. All holes bored from one setting to insure concentricities and accurate alignments

Perfect setting for a "Boring" story!



To assure smooth, efficient operation, all holes in the transmission cases of Oliver "Cletrac" crawler tractors are bored to exceptionally close tolerances from one setting. In this way, we can guarantee the exact alignment of all transmission gears and shafts, assuring economical operation and freedom from excessive maintenance.

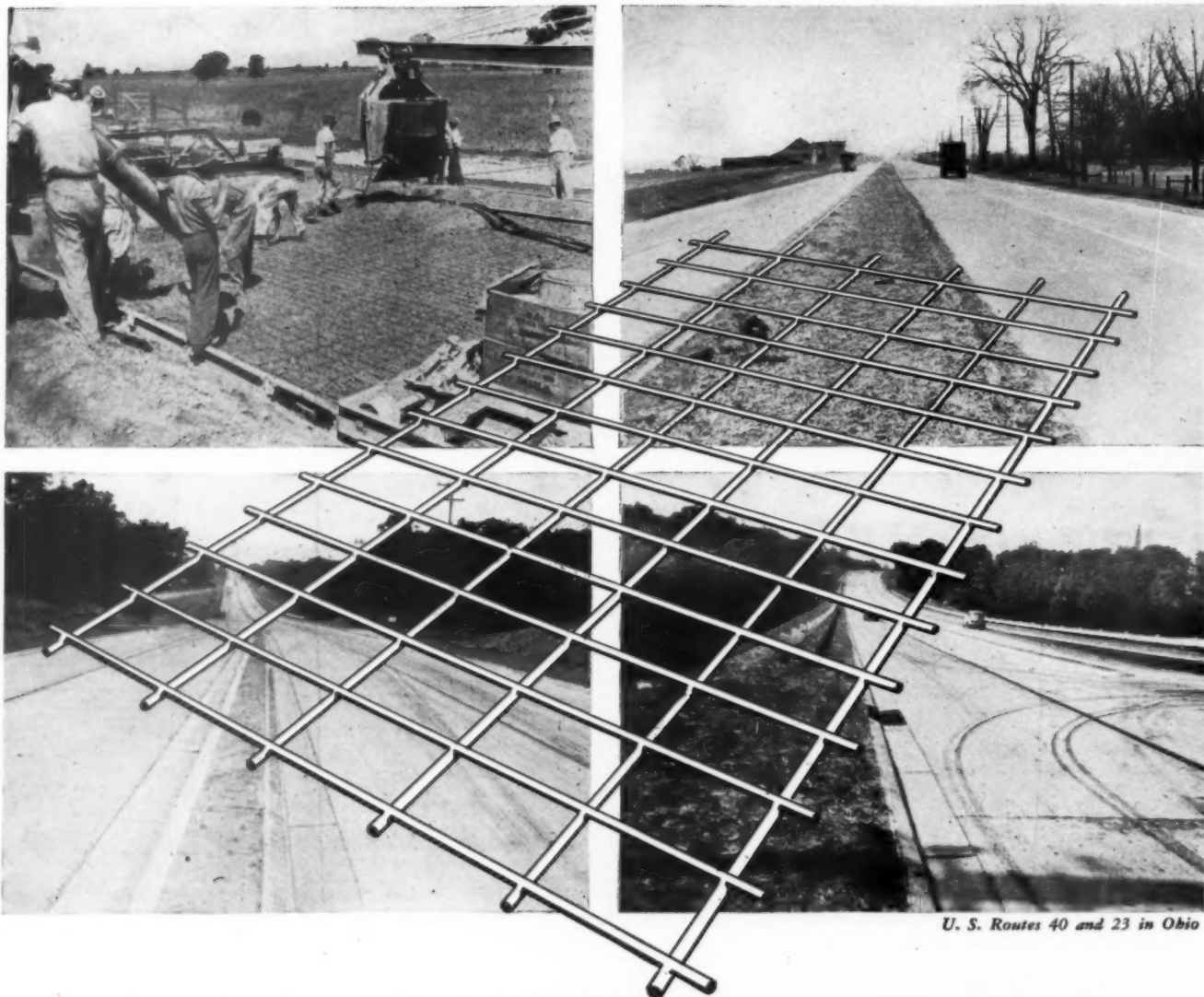
This efficient operation not only improves performance, but is another of the cost-cutting steps which make it possible for us to add *extra* quality without additional cost to you. *Extra* quality is the standard that characterizes every Oliver "Cletrac" tractor part.

Maintenance of that standard enables your Oliver "Cletrac" dealer to offer you the finest in crawler tractors for your every need.

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America's Finest Concrete Highways are reinforced with **TRUSCON WELDED STEEL FABRIC**

In every section of the country . . . in transcontinental and Canada to Gulf highways . . . in community super-highways...Truscon Welded Steel Fabric Reinforcement is assuring low cost and long life for concrete.

Engineers and designers have found by experience, practice and research that the following advantages can be expected from Truscon Welded Steel Fabric:

Provides resistance to cracking

due to shrinkage of concrete during setting period.

Provides tensile strength necessary to resist subgrade friction caused by expansion and contraction of the concrete slab.

Provides increased resistance to cracking of concrete due to warping.

Provides resistance to the development of microscopic cracks into visible cracks.

Provides resistance to cracks opening and allowing entrance of water.

Provides resistance to broken

ends of slabs separating at a crack.

Decreases spalling and progressive disintegration of the concrete.

When you plan roads, plan them well. Use structural designs that have been proved the most economical, durable and serviceable in the *long run*. Use Truscon Welded Steel Fabric with other associated Truscon roadbuilding products, and assure lasting prestige for you and more permanent highways for the communities you serve.

TRUSCON STEEL COMPANY • Youngstown 1, Ohio • Subsidiary of Republic Steel Corporation

TRUSCON

WELDED STEEL FABRIC
Covers the Continent

YOU'LL MOVE MORE YARDAGE WITH "CATERPILLAR" SCRAPERS



HERE are facts—proved on the job—that show why the new "Caterpillar" Scrapers move *more* earth—faster—at *lower* cost.

BOILING ACTION. The design of the bowl and blade-edge boil earth upward through the middle instead of forcing it up and over the sides before the middle is full. That's why "Caterpillar" Scrapers load easier, top out better. This feature means more yards per hour. The blade cuts faster and easier on hard ground and contributes to central boiling action in the bowl.

SPREADING. The big apron opening is another feature of "Caterpillar" design. It gives positive, clean ejection. Results in faster unloading—no hanging up or sticking—and more trips per hour.

OVERSIZE TIRES. Scrapers pull easier on bigger tires. "Caterpillar" recognizes this and equips its scrapers with oversize tires. On soft ground, off the road, the larger tires permit lower inflation, more tread area to absorb the weight, better flotation and higher hauling speeds. That means easier hauling, increased yardage and lower costs—plus extra tire life.

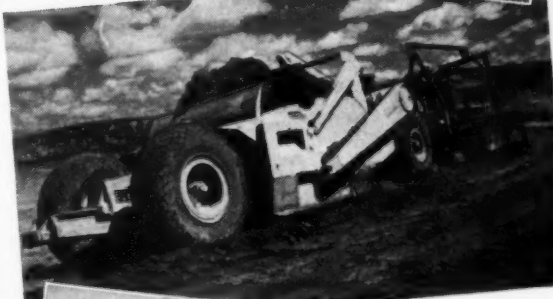
STRONG CONSTRUCTION. Rugged design, superior materials and expert workmanship increase durability. These scrapers are built to last. They have welded construction and high-tensile steels throughout. Rugged-rib bracing of the heavy double-bottom plate is provided for increased strength and wear.

NEW "CATERPILLAR" CABLE CONTROL. Sure-acting and fast. Matched to the load. Oversize machined and heat-treated sheaves and correct reeving give longer cable life.

OPEN BOWL. "Caterpillar" design achieves maximum strength without the drawbacks of an overhead frame. The operator has good visibility for loading and spreading, and the scrapers can be shovel-loaded, an important feature on many jobs.

Factory production of the new "Caterpillar" Scrapers and Bulldozers is steadily increasing. See your "Caterpillar" dealer now—find out the advantages of a full line of matched earthmoving equipment—and get your order in early.

CATERPILLAR TRACTOR CO., PEORIA, ILL.

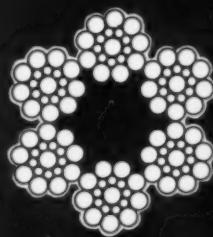


CATERPILLAR DIESEL

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ENGINES • TRACTORS • MOTOR GRADERS • EARTHMOVING EQUIPMENT

Best where wear is Hardest!



UPSON-WALTON 6 x 19 SEALE WIRE ROPE



FOR traction ropes on aerial tramways...for button conveyors and track cables . . . for car haulage systems, car pullers and spotters . . . for mine scrapers and slushers and slope haulages—many industries require a rope that is moderately flexible and still resists wear and abrasion to a very marked degree.

Upson-Walton Seale Layrite Perfection cable will outwear any other type of rope regularly used in this service. This is true because the rope is designed with coarser

outer wires which can withstand abrasion longer.

Upson-Walton Seale is your best bet where the rope comes in contact with abrasive materials or is subjected to continual dragging on the ground, or where extreme friction and slippage are encountered.

Hemp center or, where conditions are most severe, IWRC (independent wire rope center).

Perfection grade—because this improved plow steel is the strongest and toughest and most resistant to wear of all the grades of wire used to make rope.

Layrite—because this fine preformed wire rope results in longer life, greater safety and greater economy.



Established 1871

*All Upson-Walton Products Available
Through Your Local Upson-Walton Distributor*

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Manufacturers of Wire Rope, Wire Rope Fittings, Tackle Blocks

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Smooth Sailing IN STORMY WEATHER



WHEN PLOWS are BLACKHAWK HYDRAULIC CONTROLLED!

A flick of a valve and the Blackhawk Hydraulic System adjusts the blades for another bite into the blizzard. And like the men who use 'em, the men who build 'em know the ease, speed and accuracy with which Blackhawk Hydraulic Controls lift and lower plow blades. That's why Blackhawk is standard equipment with 9 out of 10 snow plow manufacturers. For dependable performance specify Blackhawk Hydraulics on ALL your road equipment. For complete information on the advantages of Blackhawk Hydraulic Controls, write your equipment manufacturer.

To Equipment Manufacturers:
Blackhawk Hydraulic Controls are engineered and priced for quantity purchase and practical installation on your products for even greater customer satisfaction. Submit your hydraulic problems to us. We will work with you in confidence.

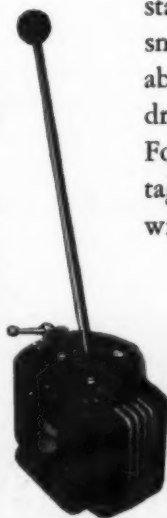
A Product of BLACKHAWK MFG. CO., Dept. RS, Milwaukee 1, Wis.

BLACKHAWK

Hydraulic Controls

POWER - DRIVEN
P-104 Power-Packer Pump—belt or gear-driven control valve is operated from cab. Compact, easily installed.

HAND OPERATED
P-60 Power-Packer Pump mounts in cab. Blackhawk is also the source for RAMS and VALVES for use with these pumps.



AT HOME *on snow and ice*



The Polar Bear

The Polar Bear does a fine job of living and traveling amid Northern snows and ice. To help him, Mother Nature thoughtfully equipped him with unusually flexible muscles that control his huge paws. This gives him the sure-footed traction to hunt his quarry in the snow and on the unstable, slippery ice floes.



WALTER SNOW FIGHTERS

WALTER SNOW FIGHTERS, too, are right at home on snow and ice . . . because they have been especially designed for that job. The unusual flexibility of the Walter Four Point Positive Drive provides maximum traction on ice and snow.

This sure-footed traction enables Walter Snow Fighters to propel 28' plows through snow at 20-30 m.p.h. This speed gives maximum snow dispersion, reduces re-handling and permits faster clearing. Thus, highways are finished quicker and secondary roads opened before snow can

form hard-packed ruts and freeze. It is traction, too, that enables Walter Snow Fighters to blast through huge drifts that stop other trucks.

This traction is derived from three automatic locking differentials—the heart of the Walter Four Point Positive Drive. They proportion engine power to the **FOUR** driving wheels according to the traction of each wheel at any instant. Even if one, two or three wheels slip, power is concentrated on the fourth to keep the truck moving until full traction is regained. No wheel-spinning, no bogging-down, no side-slipping—only a steady driving ahead. To the finest detail, the Walter is every inch a Snow Fighter. All features are described in illustrated literature. Write for it.



WALTER MOTOR TRUCK COMPANY
1001 Irving Ave., Ridgewood 27, Queens, L. I., N. Y.

WALTER SNOW FIGHTERS

TO AIRPORT AND HIGHWAY ENGINEERS

*Announcing...an outstanding advance
in concrete joint sealing compounds...FLINTSEAL*...
developed by Flintkote...makes a positive, enduring
joint... meets Federal Specification SS-F-336*

Another Flintkote product is making headline news. *Flintseal!*... a hot-poured sealing compound of the rubber asphalt type which meets the most exacting requirements for sealing joints in concrete pavements.

Exhaustive experiments in our laboratories, as well as tests in actual use have proved Flintseal's remarkable stamina and positive sealing qualities.

The Flintkote Company has long recognized past difficulties caused by uncertain application methods and materials. Now, with Flintseal, airport and highway engineers are pro-

*Trade-mark

vided with a material which offers an assured dependability... which handles economically and safely with newly developed heating and pouring equipment... a *real* solution to many of your problems.

Flintseal effectively seals joints at a wide range of temperatures and does not deteriorate under the most severe climatic conditions. It does not flow or creep during summer heat. Freezing temperatures do not make it crack or pull away from joints. Flintseal retains both body and flexibility at temperature extremes.

Write for complete information.

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"Gulf Quality Lubricants
 help us get top performance
 from equipment, fewer mechanical delays"

*says this progressive Contractor**

* Capparell Stripping & Construction Co., Hazleton, Pa., is stripping rock overburden from a large anthracite coal deposit in Luzerne County, Pa. Gulf quality lubricants are helping this contractor keep their big drag lines and Diesel tractors on the job and operating efficiently.

A LARGE SHARE OF THE CREDIT for our rapid progress and low operating costs on this stripping job goes to Gulf quality oils and greases," says this Contractor. "Gulf lubricants help us get top performance from every unit of equipment, fewer mechanical delays, and rock-bottom maintenance costs."

There are three solid reasons why so many leading contractors specify Gulf quality lubricants. One is performance—higher lubricating value and longer life—that insures less wear and smoother operation. Another is the high type of engineering service Gulf provides to insure the right lubricant in the right place. Third, Gulf's prompt delivery service.

You, too, can benefit by using Gulf quality

lubricants on your next contract. Write, wire, or phone your nearest Gulf office today and ask a Gulf Lubrication Engineer to call. He will recommend the proper types and grades exactly suited for your requirements.

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Division Sales Offices:

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dependable
Strength

...keeps Heil Hydraulic Bulldozers on the job doing more Low-cost Work for You

Because Heil hydraulic Bulldozers move more dirt at less cost, they are general favorites with Oliver-Cletrac users everywhere. These contractors like the quick, accurate blade control; the full visibility; and the fast digging action made possible by the Heil hydraulic system. They know that the scientific contour of the Heil Bulldozer blade, with its reversible cutting edge, gives a bigger load-carrying capacity than you get with conventional units.

All these things result in more work done, but that isn't all. There is one more feature of tremendous importance — dependable strength. The trouble-free hydraulic system, for example, is practically leak-proof. Large diameter cylinders permit the use of low

hydraulic operating pressures. Piston rods are chrome-plated to prevent rusting and pitting. The tolerance between the piston and its finely honed cylinder is so close that there is seldom, if ever, any need for time-consuming piston replacement.

Heil's all-welded box-section construction provides unusual strength; there is no dead weight to slow down the work. Tailor-made for Oliver-Cletrac tractors, the Heil hydraulic Bulldozer is attached by means of sturdy connections in such a way that there is proper distribution of loads and stresses. That is why Heil hydraulic Bulldozers stay on the job — turning out low-cost work. See your nearest Oliver-Cletrac distributor for further important details.

R-83

THE HEIL CO.

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How fast do you want that smooth new surface?

Today's alert highway engineers know that a road resurfaced with asphalt is a road that's smooth and glare-free... a road that's easily patched, and unharmed by wintertime de-icing chemicals.

They know, too, that asphalt makes the actual work of resurfacing easier... faster... for these important reasons:

1. Asphalt can be laid right over the existing pavement, whether brick, asphalt, or concrete.

2. Asphalt can be laid quickly, with little interruption to traffic. One traffic lane is resurfaced at a time—it's ready for use in a few hours, and meanwhile traffic continues over the other lanes.

3. Asphalt can be used to widen and modernize narrow roadways at the same time they are resurfaced, to take care of increased traffic.

4. Asphalt can be used with a minimum of manpower and a minimum investment in equipment. In fact many experienced contractors already have all the equipment necessary.

A Standard Asphalt Representative will be glad to give you details of the methods and procedure followed by other highway departments now using asphalt-resurfacing to keep up their highway systems. Call the local Standard Oil Company (Indiana) office, or write 910 South Michigan Avenue, Chicago 80, Illinois.

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The BEST COSTS LESS

For years Gar Wood has consistently offered truck and trailer equipment of utmost utility and outstanding value. Leadership in this field resulted from this policy. Gar Wood equipment costs less in the long run because it is better built to give peak performance and lasting satisfaction.

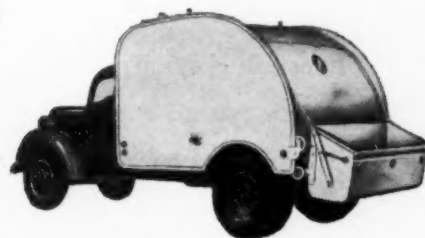
TRADE MARK



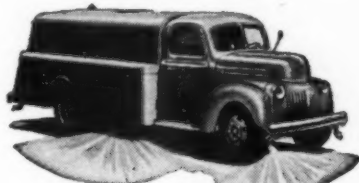
The Load Packer (patented) all enclosed garbage and refuse unit. Compresses loads hydraulically for maximum payloads.



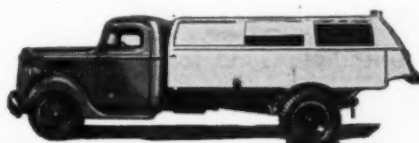
Type C28 scow end Garbage Body. Steel hinged covers extra equipment.



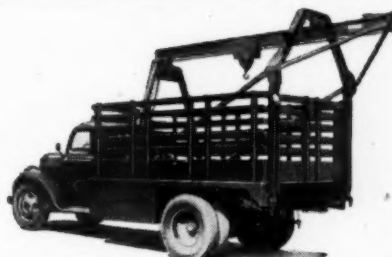
The new Bucket Loader, an all enclosed sanitary refuse disposal unit.



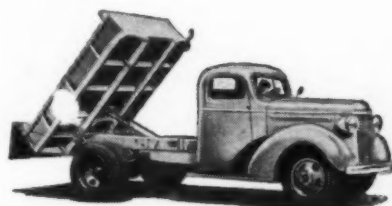
Street Flushers and Sprinklers.



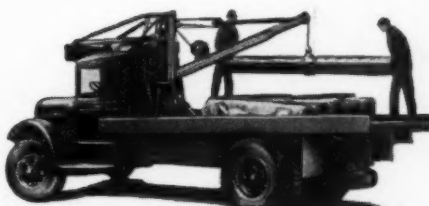
Type C50 Garbage Body with sliding steel covers on each side.



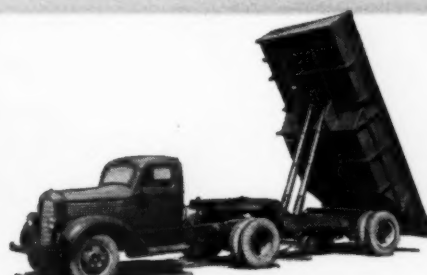
Model "QD" Tree-moving Crane. Easily erected or removed from all purpose stake body.



Type C12 Body and Model D6 or D7 Hoist. Dumping angle 55°.



Telescopic boom Crane. Boom radius 8 to 20 feet.



Special W28 Garbage Body, watertight top box. Capacity 7 cu. yds. Type T333 telescopic Hoist.



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Ideal size and capacity for a maximum range of work . . . quickly and economically digs trench for service pipe, small sewerage pipe, water and gas mains, electric and communication cable conduits, roadside drainage, interbuilding steam ducts and foundation and footing trench for large buildings. Advanced design makes it tomorrow's way of trenching — but it can be yours today. Send for Bulletin.

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Digging Depth: up to 11½'.
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Shiftable arcuate conveyor.
20 cutting speeds, forward; 4 reverse.
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Only 6'3" wide, 29'6" long (max.), 11'10" high (max.).



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CAN STEER A BIG TRUCK



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with **VICKERS** Hydraulic POWER STEERING

We don't expect a small boy to drive a big truck, but his strength is many times equal to the steering effort required if the truck has Vickers Hydraulic Power Steering. The steering wheel turns with effortless ease, and the front wheels always follow exactly.

Moreover, no matter how rough the ground, no road shock can get to the driver. The steering wheel cannot spin, or jerk—the vehicle can be driven over the curb or through sand with no "fight" from the wheel. A flat tire will not cause swerving. The driver is relieved of the most fatiguing part of his job—enabling him to work faster and longer with greater safety.

Vickers Hydraulic Power Steering is simple, compact, easy to apply to existing chassis designs. It has automatic protection against abuse and excessive steering reaction forces. Lubrication is automatic. Fifteen years of successful operating experience on trucks, buses, road machinery, etc. have proved the value of Vickers Hydraulic Power Steering. Write for Bulletin 44-30.

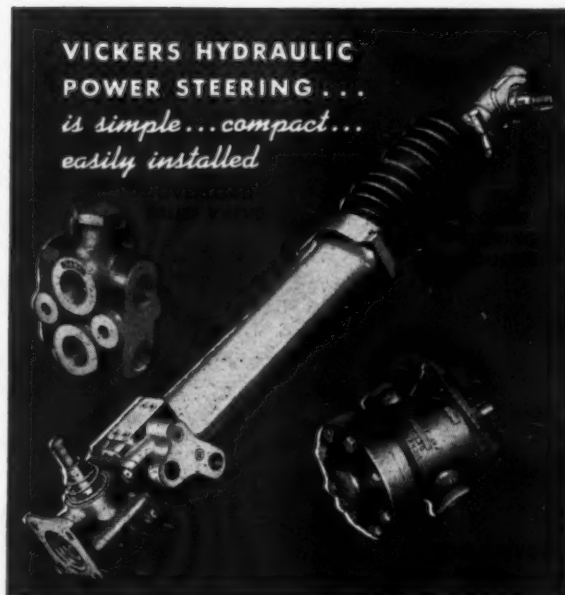
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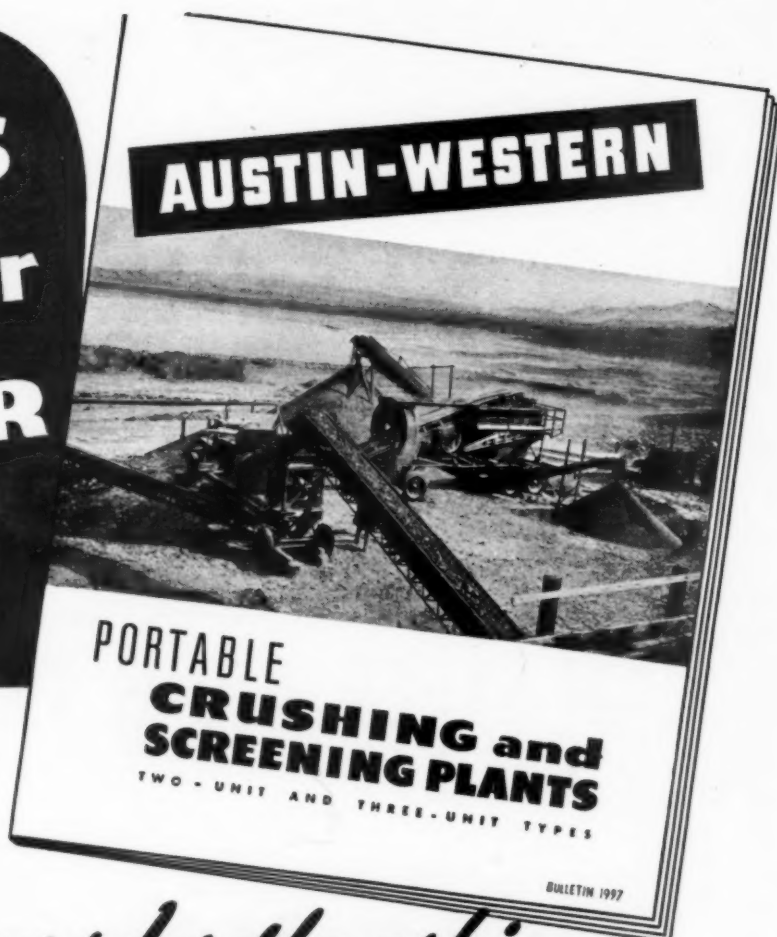
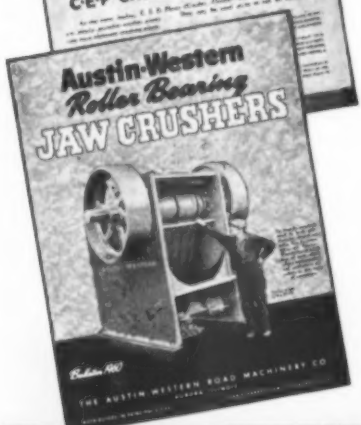
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41

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1999 Two-Unit and Three-Unit Crushing Plants . . . 1960 Jaw Crushers
1991 C. E. P. (Crusher, Elevator, Power) Plants . . . 1933 Roll Crushers

• The Post-War demand for crushed aggregate for highway and all other forms of construction is already tremendous and growing day by day. Austin-Western is ready with a full line of job-tested equipment, including:

Jaw Crushers and Roll Crushers in a wide range of sizes; plus matching screens, elevators, conveyors and bins.

Portable Crushing Plants, from the smallest to the magnificent Two-Unit and Three-Unit Plants which combine maximum output and variety of specification on the one hand, and maximum economy of operation on the other; giving the owner flexibility of operation that spells maximum profits.

Your nearby Austin-Western dealer will be glad to recommend the plant best suited to your needs.

AUSTIN-WESTERN COMPANY, AURORA, ILLINOIS, U.S.A.

BUILDERS OF ROAD MACHINERY

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SINCE 1859

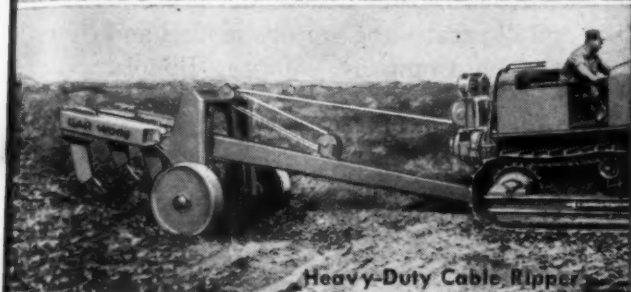
Down-to-Earth Engineering

**GAR WOOD Cable Controls Feature
Rugged Simplicity and Direct Action Pull**



Cable Dozer

The cable goes direct to the job in GAR WOOD Cable-Controlled Road Machinery. As a result, it has fast action, positively controlled.



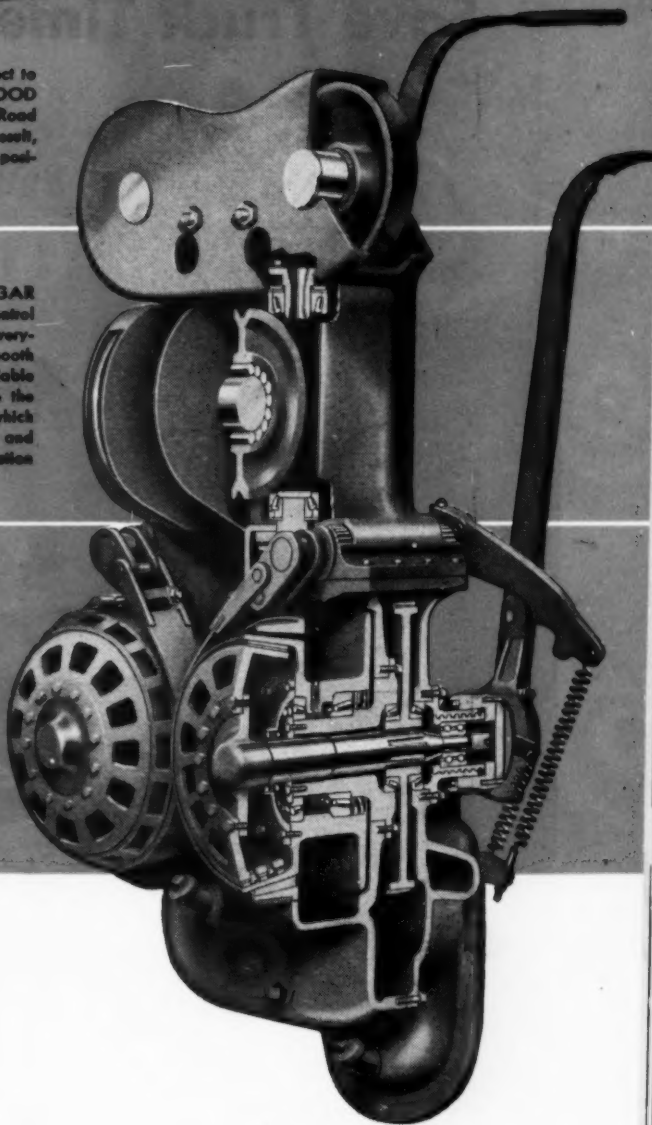
Heavy-Duty Cable Ripper

The job-proved GAR WOOD Cable Control Unit (right) has everything it takes for smooth operation and reliable performance. Note the sturdy steel housing which prevents distortion and serves as a lubrication chamber.



4-Wheel Cable Scraper

Outside clutches and servo-type, self-energizing brakes cool themselves and are readily accessible. Roller bearings throughout and spur-type gears keep adjustments at a minimum.



PROVED through the years on the toughest of jobs. Made more rugged than ever by the lessons learned in war action on every front, from Guadalcanal to Okinawa and from Oran to Berlin.

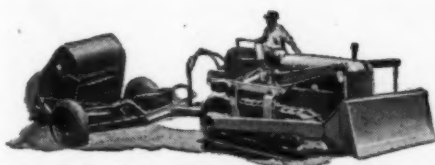
GAR WOOD Road Machinery and the famous GAR WOOD Cable Control Power Unit offers practical design and sound construction, well engineered and honestly built—equipment that *holds together* and can be operated with an absolute minimum of down time. *If it's GAR WOOD, it's good.*

See your Allis-Chalmers dealer. He'll be happy to give you all the facts and show you Gar Wood Earth Moving Equipment *on the job* in your own vicinity.

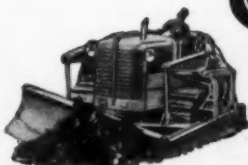
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Gar Wood 2-Wheel Hydraulic Scraper and Bulldozer



Gar Wood Hydraulic Dozer.

OTHER GAR WOOD PRODUCTS: HOISTS AND BODIES • TANKS • WINCHES AND CRANES • HEATING EQUIPMENT • MOTOR BOATS

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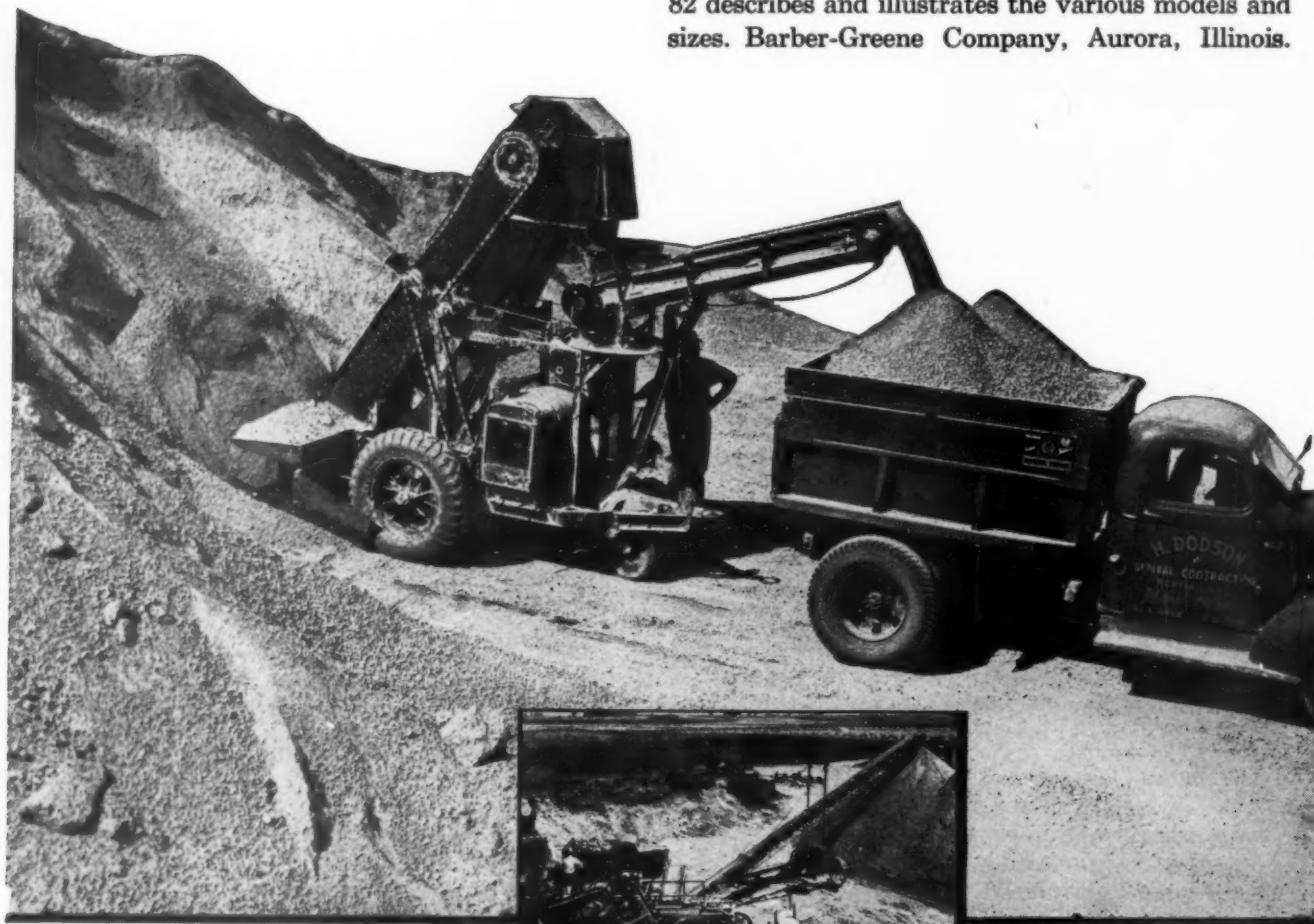
BG *Bucket Loaders*

Save Truck Time

• Saving truck loading time is the equivalent of adding trucks to your fleet. And, Barber-Greene Bucket Loaders *are* saving truck time every day through their high capacity and efficiency in loading from stock piles. They're specially designed for this job—a job no other method approaches from the standpoint of saving time.

In addition, Barber-Greene Bucket Loaders are easily maneuvered around the yard or pit, and, where conditions warrant, can be equipped with a special high travel speed for moving from stock pile to stock pile.

The Barber-Greene Bucket Loader Catalog No. 82 describes and illustrates the various models and sizes. Barber-Greene Company, Aurora, Illinois.



46-5

This B-G Portable Belt Conveyor provides a flexible storage system for bulk materials ... builds long parallel piles or large radial stock piles.



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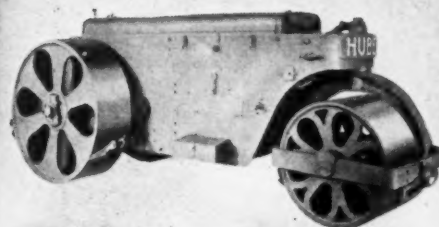
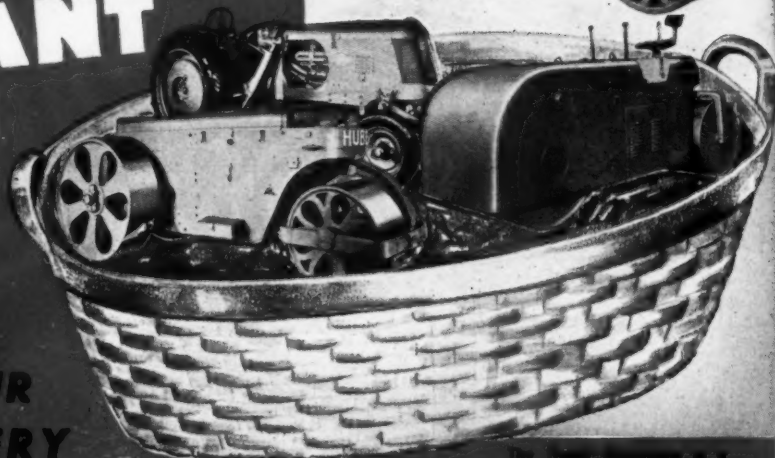
- Huber has the **EXPERIENCE** of many years standing, so essential in building dependable road machinery.

- Huber has the **KNOWLEDGE** important to cope intelligently with road building and maintenance problems and to prescribe for an economical solution.

- Huber offers a **COMPLETE LINE** of 3-wheel Road Rollers and Tandem Rollers and a Maintainer that is eight machines in one.

- Huber's manufacturing **FACILITIES** are "geared" to meet maximum demand, once material shortages are licked.

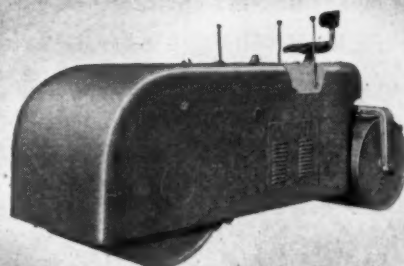
- Huber's splendid distributor organization, strategically spotted throughout the country, joins the company in preserving its policy of **UNDIVIDED RESPONSIBILITY**.



Huber 3-Wheel Rollers are available in 3, 4, 5, 6, 8, 10, and 12 ton sizes.



The Huber Maintainer is a versatile machine to make short work of road and airport maintenance.



Huber Tandem Rollers are built in 3, 4, 5, 6, 8, and 12 ton capacities.

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3 Wheel • Tandem
**ROAD ROLLERS
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- Easy on the Operator
- Easy on the Machine

The quiet, easily controlled, coordinated performance of Bucyrus-Erie excavators results in greater output because it means less operator fatigue, less wear on the machine itself. The operator, working with easily manipulated responsive controls, finds it easy to keep a Bucyrus-Erie working at top speed without becoming excessively fatigued . . . without experiencing the end-of-shift slow downs that cut output. Smooth performance means more consistently efficient machine effort, too. It means that the operator gets full use of engine power all through the shift because losses due to friction and vibration are tremendously reduced. It means

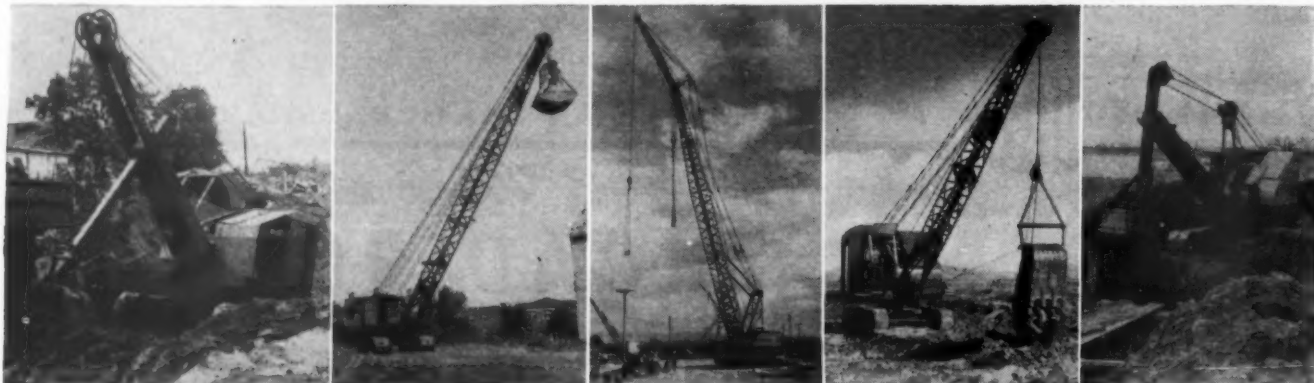
that maintenance requirements are lower because it indicates accurately machined close-fitting parts held in lasting alignment and operating with the smoothness that cuts wear to a minimum. Yes, quiet coordinated performance is a big reason why Bucyrus-Eries consistently outproduce other machines. Check with men who have operated Bucyrus-Eries, or watch one at work yourself. You'll be convinced that Bucyrus-Eries are your best bet for big output. BUCYRUS-ERIE COMPANY, South Milwaukee, Wisconsin.

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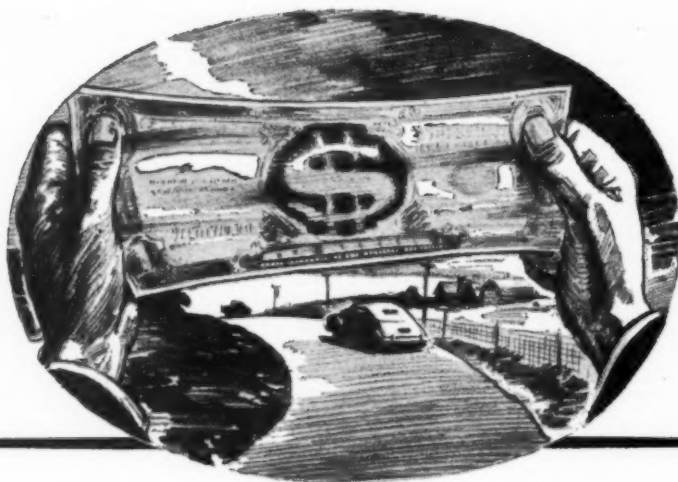
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Send for booklet explaining
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S-T-R-E-T-C-H *your Highway Dollars*

Soil stabilization has shown the way to lower road-building costs through the utilization of native, in-place materials. Now it is possible to definitely pre-determine strength . . . to really engineer such roads. The science of soil stabilization is ready to serve you.

The next step is ready, too — the machinery to perform the necessary operations in the most efficient manner. This is the problem solved by the P&H Single Pass STABILIZER which fulfills these 8 basic requirements in building stabilized roads:

1. Control processing depth for accurate proportioning
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8. Do all these things in one pass — at a good rate of speed.

By reducing all these operations to one pass — with any type of admixture — the P&H Single Pass STABILIZER makes road dollars go further than ever before.

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Today's demands on powered industrial equipment call for round-the-clock operation—on the farm—in construction—in the oil fields—in the lumbering industry and in many other applications.

Here Chrysler Industrial Engines are at their best. High compression, flexible horsepower mean compactness and low weight. Chrysler Superfinish brings greater economy, efficiency and long life.

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A Chrysler Industrial 5 engine propels this combine and drives the threshing and cutting mechanism with ease.

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11

SNOGO *gets the kids to school*



and back!

Snow clearance even affects education! 96% of the one-room schools, many of which should be abandoned for consolidated schools, are on other than main roads often impassable in winter.

Your county properly equipped with Snogos can keep these roads open, eliminate banks that drift back and entail extra cost and time in "repeat plowing".

Snogo assures open winter roads bringing greater safety for the 80 to 90 thousand school busses that average 25 miles a winter day transporting 4,400,000 young Americans. Snogo means that your children and your neighbors' children get to school *and back*.

There is a Snogo for every county, state and city budget. Plan ahead to improve winter highway conditions in your area. Details on request.

**KLAUER MANUFACTURING COMPANY
DUBUQUE, IOWA**

Snogo throws the snow into the field where it can do no harm. It cuts away the deep side as well as the low side of the drift. There will be no hazardous one-way bottlenecks with half the road blocked to the center line. "Ice sheet" with its dangerous ruts is eliminated and the cost of repeat plowing because of drifting is eliminated.

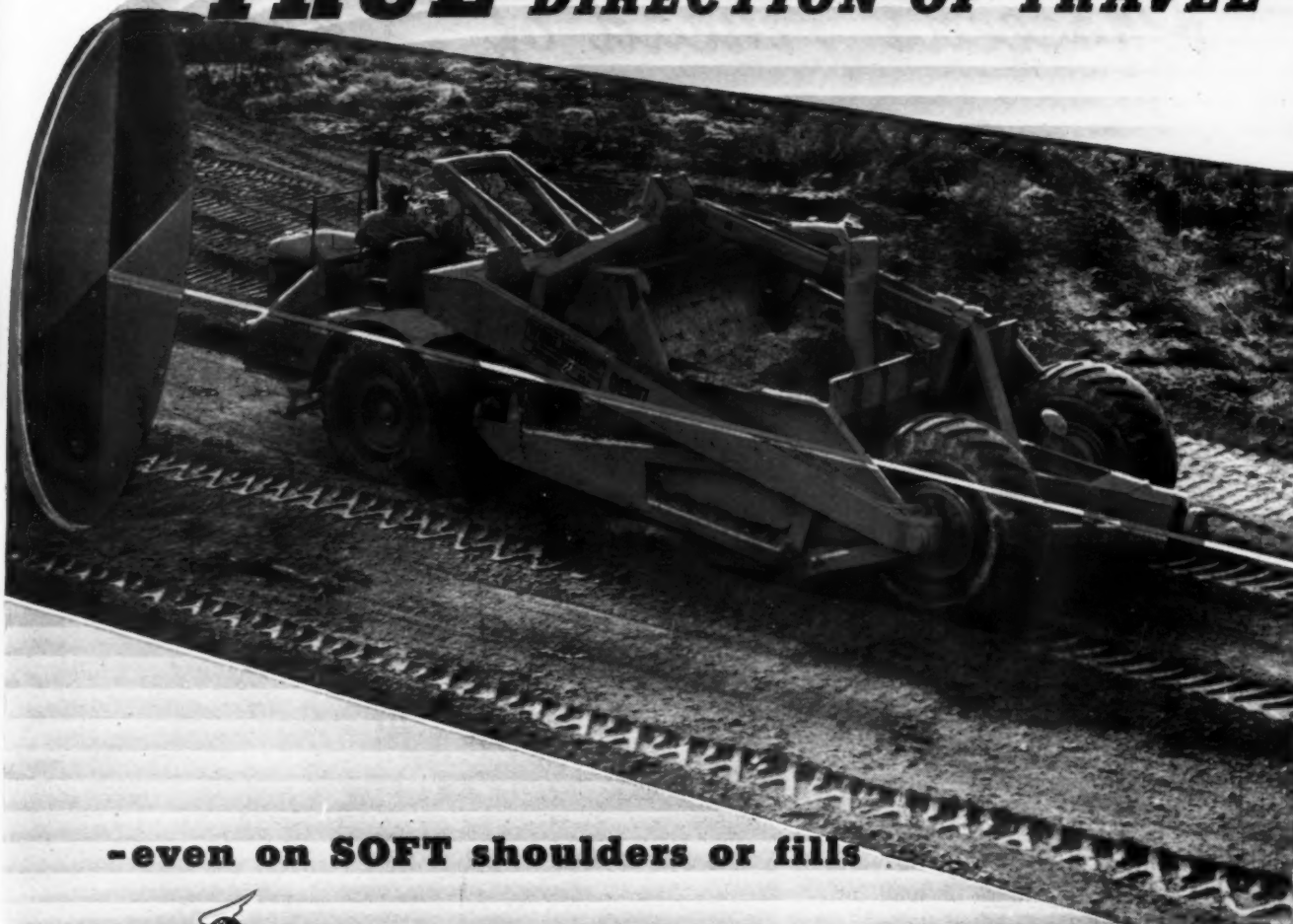
Snogo is a proved machine with 19 years of service in the field. Snogo equipment can be depended on by your department and your community when it is needed.



SNOGO

**A SNOGO For
EVERY BUDGET**

TRUE DIRECTION OF TRAVEL



-even on **SOFT** shoulders or fills

WOOLDRIDGE

EARTHMOVING EQUIPMENT

Includes



★ SCRAPERS

Tractor-drawn for handling heaping yardages from 6 to 28 cu. yards.



★ POWER CONTROL UNITS

Single and multiple drum with universal or roller fairleads.



★ BULLDOZERS

Tough and rugged design for standard makes of tractors.



★ TRAILBUILDERS

Adjustable angle-blades for standard tractor mounting.



★ RIPPERS

Available in light, medium and heavy duty models with two sizes to each model.

DISTRIBUTOR SALES & SERVICE FACILITIES IN ALL PRINCIPAL AREAS & FOREIGN TERRITORIES

Due to their exclusive, hydraulic steering system Wooldridge Terra-Cobras always maintain a fixed direction of travel over all types of ground including soft or slippery surfaces. Obstacles such as rocks, ruts or timbers in their path will not cause these high speed earthmovers to veer from their set course. A single steering bar permits operator to maintain positive *two-wheel* steering control from a fraction of a degree to a sharp angle turn. With no effort required, operators are able to maintain higher yardage averages throughout an entire shift. To keep yardages on the move investigate Wooldridge Terra-Cobras for your jobs—today!

WOOLDRIDGE
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SUNNYVALE • CALIFORNIA • U. S. A

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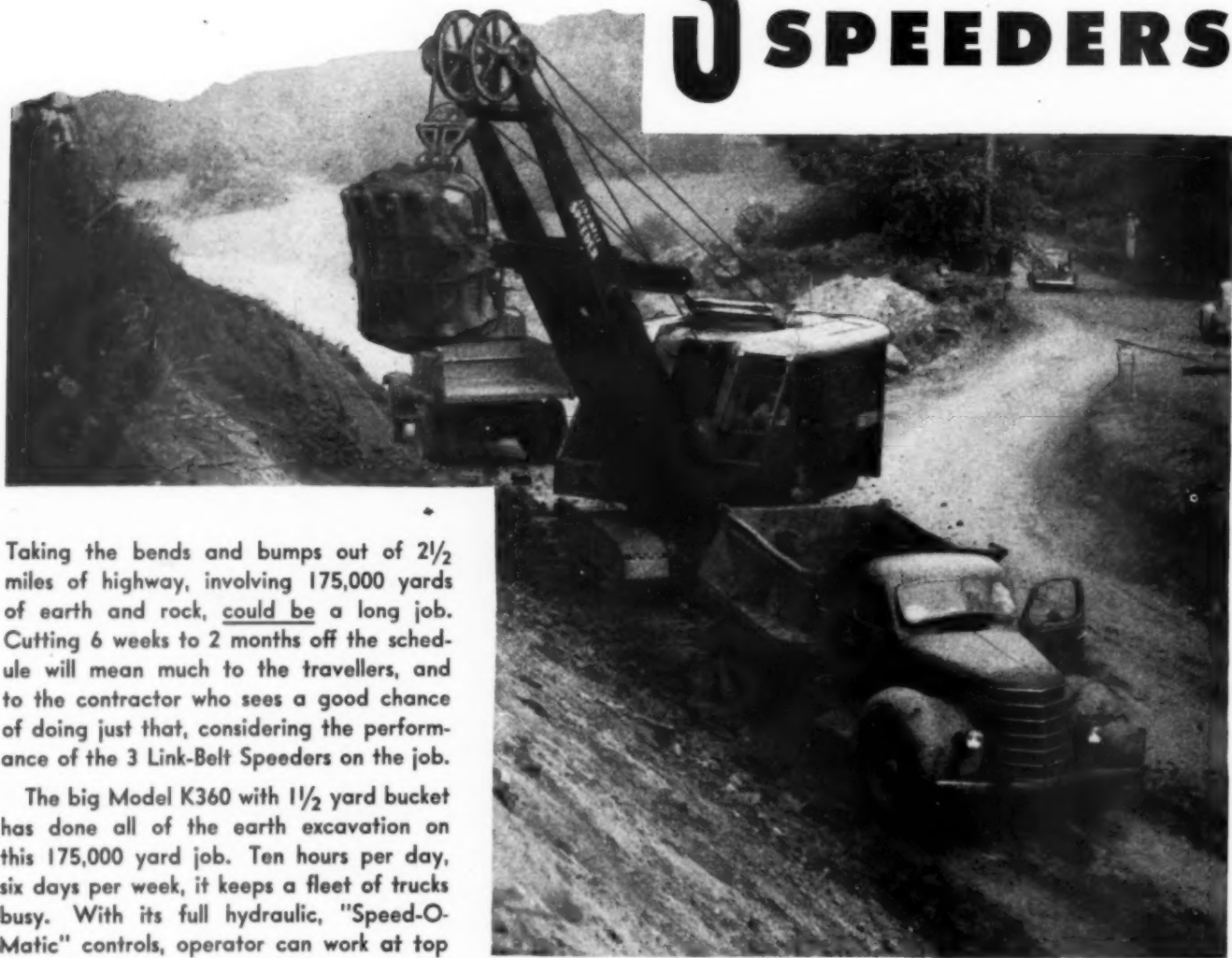


**Hi-Speed Self-Propelled
EARTHMOVERS**

DE-KINKING *a* HILLY HIGHWAY

Proceeds Ahead of Schedule

Thanks to **3 LINK-BELT SPEEDERS**



Taking the bends and bumps out of 2 1/2 miles of highway, involving 175,000 yards of earth and rock, could be a long job. Cutting 6 weeks to 2 months off the schedule will mean much to the travellers, and to the contractor who sees a good chance of doing just that, considering the performance of the 3 Link-Belt Speeders on the job.

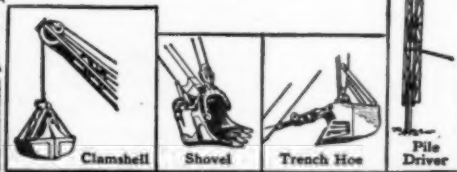
The big Model K360 with 1 1/2 yard bucket has done all of the earth excavation on this 175,000 yard job. Ten hours per day, six days per week, it keeps a fleet of trucks busy. With its full hydraulic, "Speed-O-Matic" controls, operator can work at top speed all day, with no fatigue. Speed, power and easy handling with the K360 all add up to top-capacity performance.

A Model LS-85, rigged as 3/4 yd. trench-hoe loads out shattered rock from drainage ditches after blasting. Another LS-85 with 3/4 yd. shovel, is in constant use at a sand and gravel pit 6 miles distant. Both LS-85's are veterans of war construction work, still going strong!

Owners of Link-Belt Speeder machines keep up with changing jobs by taking advantage of the quick, easy convertibility of their machines. Changing shovel into dragline, crane into trench-hoe or pile driver, is a matter of hours, and they "Keep in the Bidding" with their Link-Belt Speeders.

LINK-BELT SPEEDER

Builders of the Most Complete Line of
SHOVELS-CRANES-DRAGLINES
LINK-BELT SPEEDER CORPORATION, 301 W. PERSHING ROAD, CHICAGO 9, ILL.
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PNEUM

Whe

why LEADING OPERATORS specify *Thor* ROCK DRILLS



The Engineer knows this sturdy chuck is easily replaceable . . . less expensive

THE CHUCK of a rock drill holds the drill steel in alignment. Located at the "business end" of the drill, it is most vulnerable to wear since it must take the punishment of steady rotation plus constant pounding against the collar of the steel.

To maintain efficiency and protect against excessive steel breakage or damage to the piston hammer, the chuck, while extremely rugged, still must be replaced regularly.

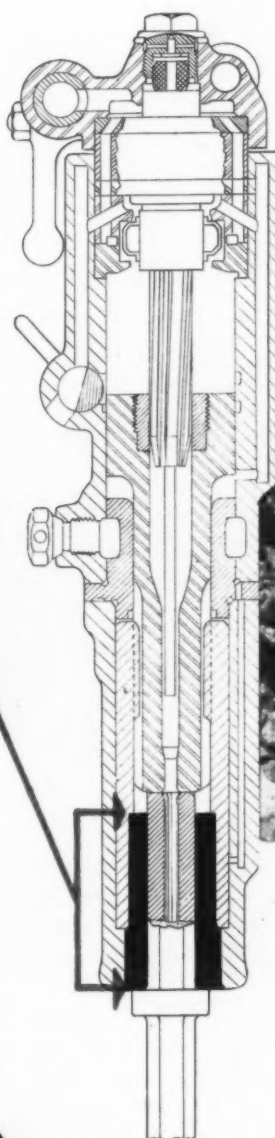
In THOR Rock Drills, the chuck assembly is designed so that this replacement is quick and easy . . . and twice as economical because THOR Chucks *cost less to replace!*

Ask your engineer to check this and other THOR advantages—He'll agree—your nearby THOR Distributor stocks the tools that will give you more work . . . *at lowest cost!*

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● Much costly hand work can be eliminated because the Koehring 605, equipped with the new Koehring Power Clutch, makes smooth sloping easy for any operator.

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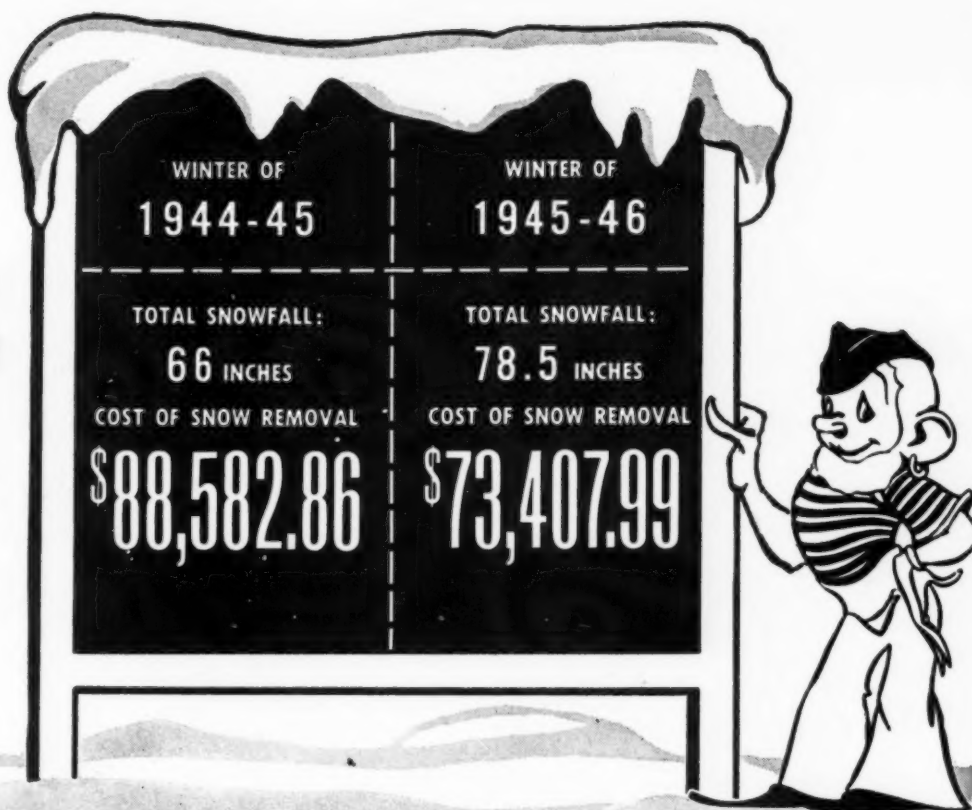
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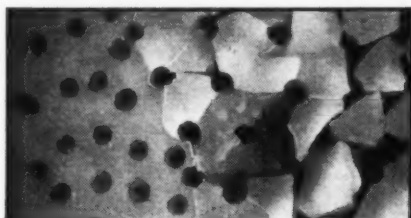
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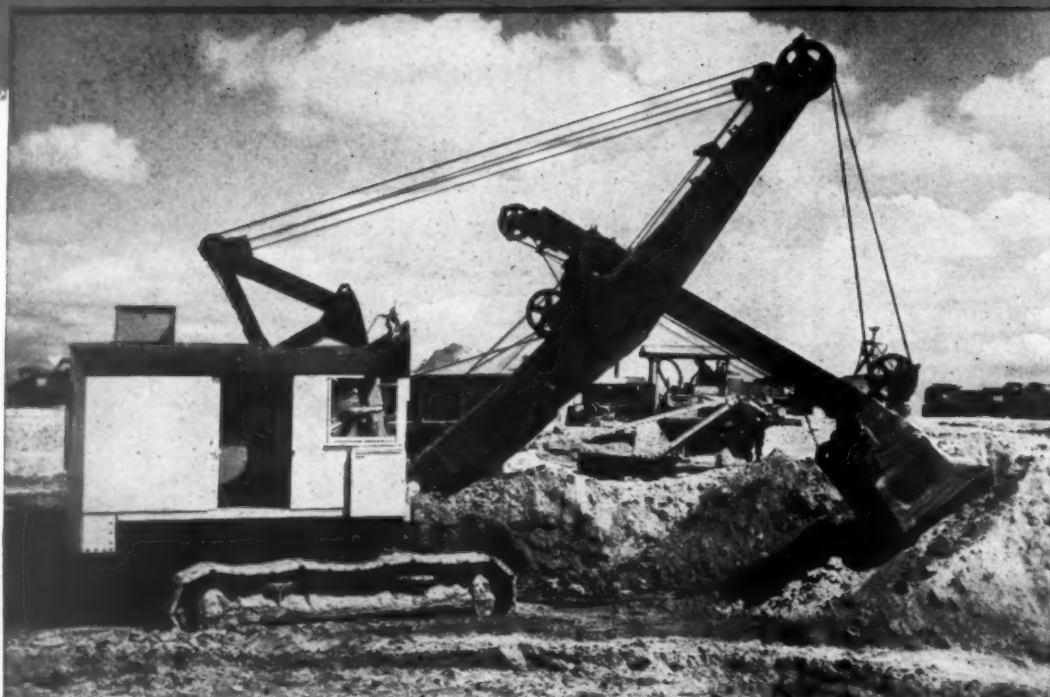
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Resurfacing Packard's Famous

Test Track

How 2½-mile pavement at Packard proving grounds near Detroit is being restored after severe use by tanks during the war

ONE of the casualties of the war on the home front was the road used for testing facilities since 1926 by the Packard-Motor Car Company for automotive testing and experimental runs. This 2½-mile portland cement concrete track, located at the company's proving grounds near Utica, Michigan, had remained in excellent condition up to the beginning of the war. Steel tired tanks, given endurance runs here aggregating hundreds of thousands of miles by U. S. Army Ordinance under separate lease, inevitably caused extensive wear and damage to the pavement, which was designed for relatively light rubber tired traffic.

The present repair program, the Packard people have made clear, is in reality a restoration in kind. Complete resurfacing with an over-lay consisting of 6 in. minimum thickness of concrete will be completed this season, under a contract awarded to Julius Porath & Son Co. of Detroit. Air entraining concrete with air entraining ingredients ground in the cement is specified.

100 M.P.H. Track

First, to describe the track a bit. It consists of two circular end sections separated by 2,640-ft. straightaways. The circular sections have an inside radius of one-quarter mile. The pavement is 55 ft. wide throughout. The central 1,880 ft. of each straightaway was built to an uncrowned cross-section

with slopes 1° transversely inward for drainage. Next comes 345 ft. of transition on tangent in which the pavement warps toward the beginning of the turn. Then 240 ft. of circular transition section takes the driver into the fully superelevated and warped central portion of each end, 3,580 ft. in length.

Throughout the fully elevated turns the pavement is cross-sections as follows: The inner 10-ft. lane continues on a 1° transverse slope, as with the transitions and straightaway; the next two 10-ft. lanes are also flat but inclined 11° inward; the outer portion, 25 ft. 9 in. wide (surface measurement), curves upward until at the outer edge the pavement slopes 35°.

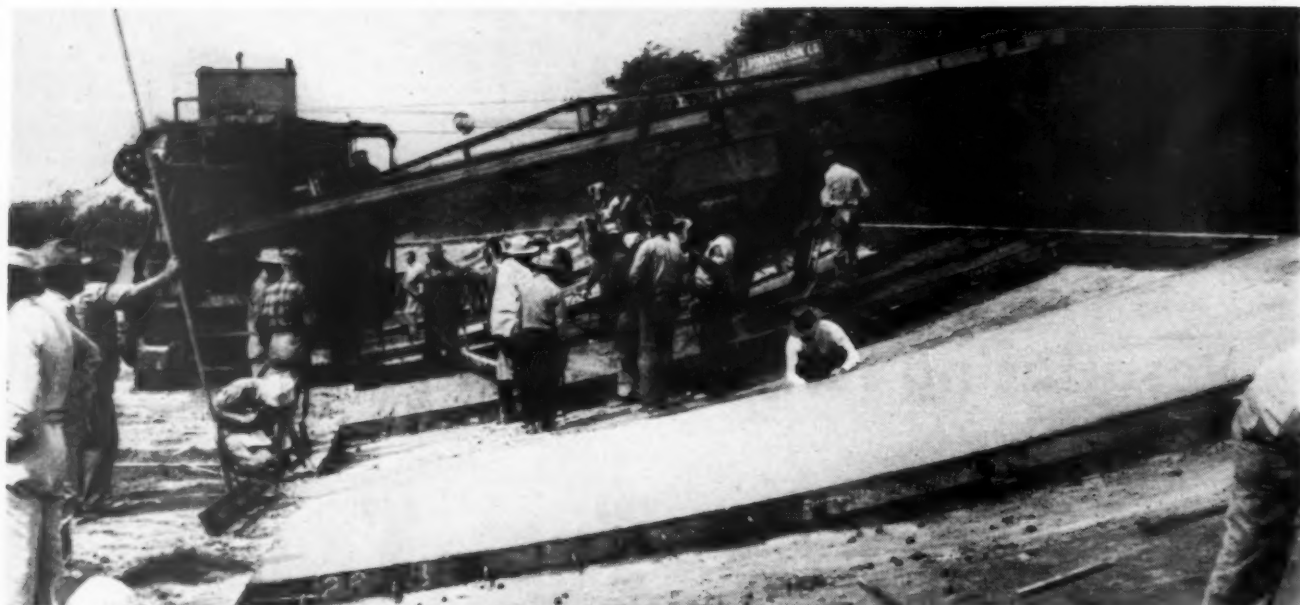
Test drivers thus have their choice of superelevation for any speed. In fact, from straightaway through transit and full curve the track was scientifically designed to take a car around the turn at "design speeds" up to 100 mph. without need to touch the steering wheel.

Based on service experience a slight correction in the details of the transition was embodied in the recap, but the central curve cross-section and other details are being reproduced unchanged. Before the war the pavement had been maintained with great care, particularly with respect to joint maintenance and avoidance of extruded filler material.

The pavement was originally built

★ Special strike-off template in use on the fully superelevated turn





★ Concreting along the turns required unusual elevation of the paver boom. Slab was finished in alternate panels at transitions (see article)

with staggered cross joints. After tank testing began some breaks appeared at interior corners, but the principal damage from tanks was the severe general wear and surface damage on the three inner lanes all around the track. The outer lanes on the curves were untouched, excepting along the lower joint, and are being resurfaced today only because it was deemed more economical and satisfactory to completely resurface the track than to repair the damaged portions.

New Pavement Details

Unlike the old pavement, the new will have expansion joints at the ends of transitions and one midway along each turn. Contraction joints of $1\frac{1}{2}$ to 2 in. depth, doweled but not keyed, are provided every 50 ft. along straightaways, and every 370 ft. 6 in. along fully superelevated portions of curve. Full depth cross joints are spaced every 15 ft. along the transition or warped sections. The 15 ft. spacing of cross joints on transitions

was chosen in order to give the contractor smaller sections in performing the hand finishing involved. Transverse joints were keyed only on warped or curved portions.

Longitudinal construction joints in the resurface slab are also keyed, and tied with $\frac{1}{2}$ -in. bars.

Transverse joints in the recap are not staggered and are located about midway between the staggered positions of underlying joints. To help spread stresses over old joints, $\frac{3}{4}$ -in. dowels were specified to be 30 in. long. Dowels are spaced on 18-in. centers at contraction joints and 12-in. centers at expansion joints.

A bituminous wedge course using graded aggregate $\frac{3}{4}$ in. down and SOA (85 to 100) penetration was used on the entire inside 30 ft. of the original track and where required on other portions to establish a uniform grade before recapping with concrete.

Old slab areas not covered with a bituminous wedge course were swept and given a tack coat of .10 to .15 lb.

per sq. yd. of asphalt emulsion (AE-1 Michigan specifications). The emulsion was sprayed on by hand from a distributor.

The entire job is being handled with a 34-E dual drum paver, batching from a standard plant located inside the grounds. Straightaway sections were paved first, using standard mechanical finishing equipment. This equipment was also employed to pave the first three inner lanes around the transitions and turns, and no difficulty was encountered in paving on a 11° slope.

Warped Section Finish

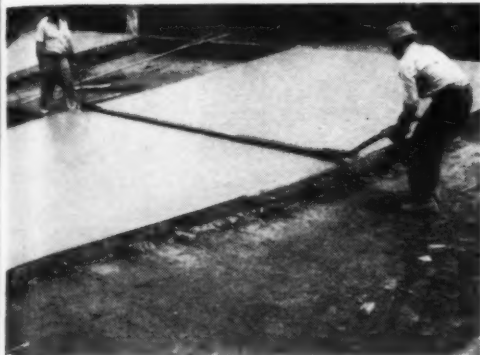
The complication began, from a construction standpoint, as soon as the contractor hit the first warped section. As pictured here in various illustrations taken by Packard Motor Car Company and the "Roads and Streets" editor, all mechanical equipment was thrown aside and the transition tackled by hand. Aided by the Packard engineering staff, which set up painstaking procedures for checking and double checking to insure a perfect surface, the contractor set curved header boards at every joint and concreted alternate 15-ft. panels.

Each header had to be tailor-made to its transition crown. Superimposing the new surface over the old was done in such a way as to result in a variable thickness of new pavement, and it was necessary to take levels at several points along each header. The boards were shored up on temporary blocks, and a dam of bituminous cold-mix thrown under the boards, the mix being shoveled away



★ The 34-E dual paver employed was equipped with a special hoist drum for elevating concrete into the high outer lanes

★ Cutting dummy groove for longitudinal joint in outer lane of a transition. Grooves later sealed with poured rubber compound



★ Looking past a transition into the fully superelevated circular turn, 3600 ft. long at either end and to be finished mechanically with special equipment



★ Concrete on transitions was finished by hand throughout. A heavy screed was sawed and dragged up the slope.

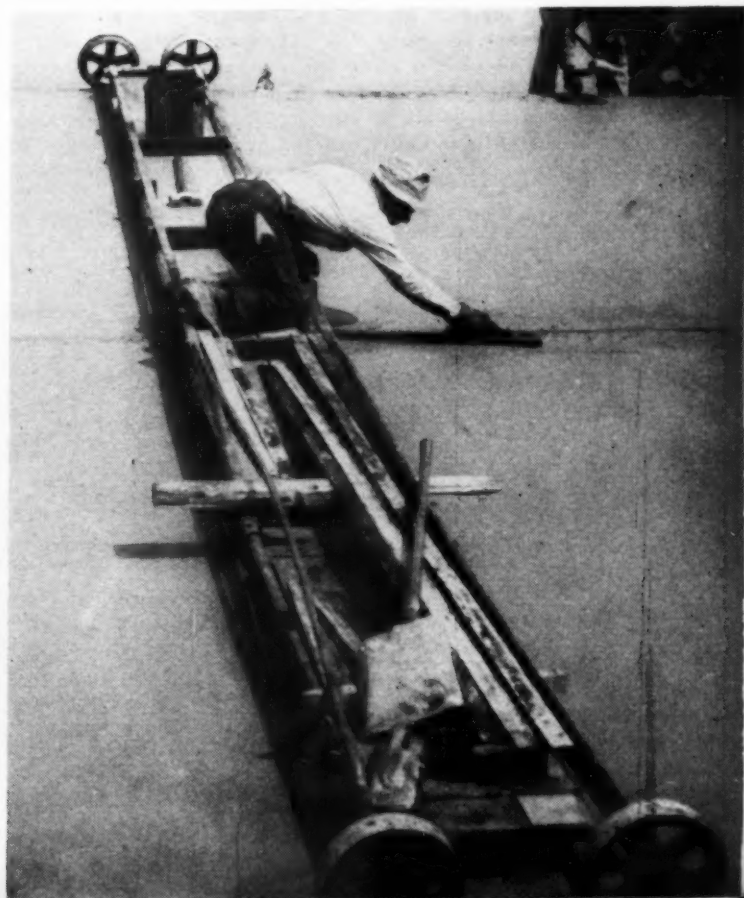
★ Premoulded bituminous board was used to form keyways where specified

★ This specially arched bridge was usable either right-side-up, or upside-down as shown

Curve Transitions were a Hand Finishing Job



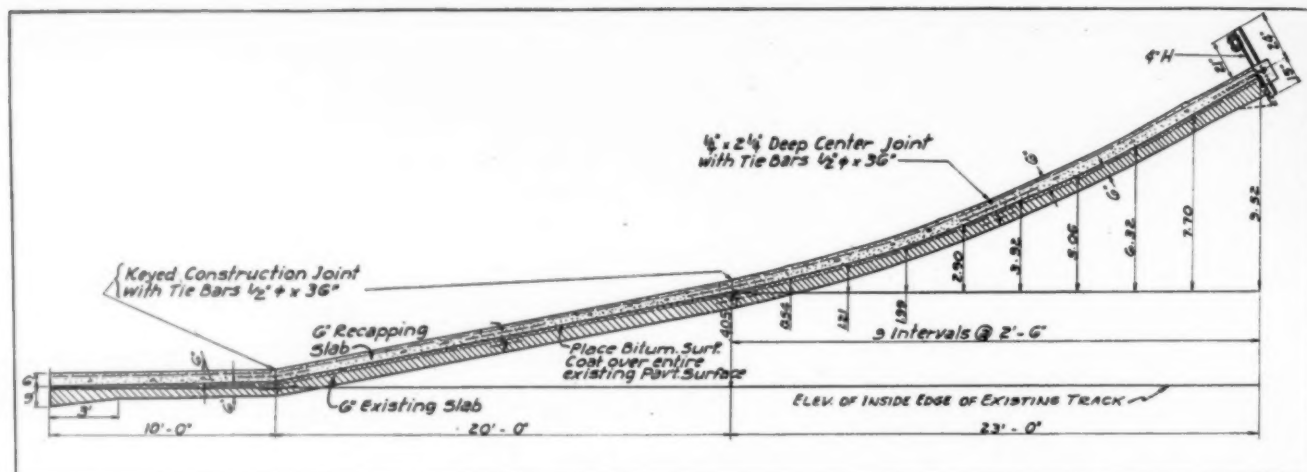
★ Floating and hand finishing of panels in a transition



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★ Cross section of the turns, designed for variable speed automobiles testing up to 100 mph

from either side just before placing concrete. Header forms were held by pins driven into the ground through holes in the old slab and to which forms were fastened with 1 1/4-in. "U" bolts.

The entire new slab was designed with a 9 x 6 in. drop section or lip which hooks over the upper edge of the old slab to assure anchorage. This lip is reinforced by special 1/2-in. hooked bars, 30 in. long, spaced 18 in. apart and held in position with two lines of light tie bars.

Finishing concrete high up on the super-elevation was quite a job, but Porath's men soon caught on. Concrete with a slump not exceeding 1 in. was specified. The work was aided by a mechanical feature of the paver bucket, which permitted controlled dropping of concrete in such a manner as to sprinkle it over a wide area, thus saving hand spreading. The first batch was placed as close to the outer form as possible and then the lower areas of the section were covered. This was done to anticipate and avoid any piling up of excess concrete on

the low side.

A heavy strike-off screed was then worked upward across the header boards, two men manipulating and two to four men pulling the screed along with ropes. Reinforcing mesh was placed at a level 2 in. below the surface, and the remaining concrete lift placed with care to minimize the need for hand spreading. No vibratory equipment was used except at outer forms.

Four or five alternate panels were maintained in various stages of finishing through the transitions. Finishing consisted of working over with long handled floats, one from the high side and one from the low side; cutting dummy joints from a bridge using a 2-man joint bar; burlap drag finishing; troweling and edging; and burlap cover.

The second day, burlap was taken up, surface checked with a 10-ft. straight-edge, to a plus or minus 1/16 in. in any 10 ft. section and high places, if any, ground down, and earth cover placed and kept wet for seven days.

★ Another view of the strike-off machine. In foreground, note joint assembly resting on paper



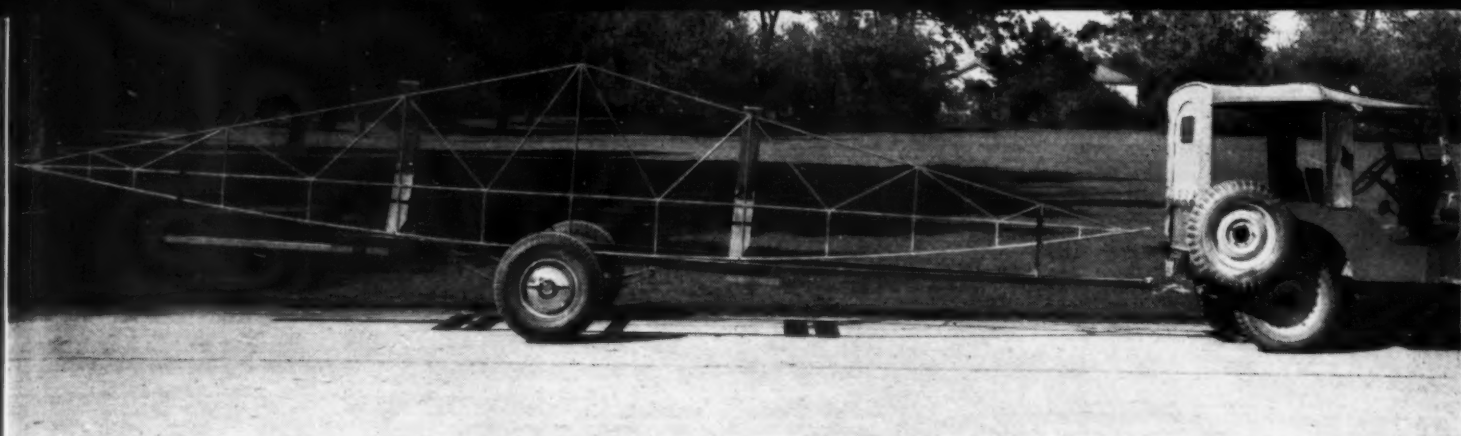
Finishing the Turns

The chief construction problem with the contractor was to devise some mechanical means of finishing concrete along the 7,160 ft. of fully super-elevated turns. For this job he built a special outfit following the design used by the original contractor, R. D. Baker. A frame was fitted over the top of a standard finishing machine. Hinged at one end and equipped with a hoist at the other, this frame is adjustable for height. Hanging from the frame is a solid row of small metal "cans" or cylinders, suspended from piston rods and so adjustable individually as to form a strike-off template of any desired irregular or curved pavement crown. As the finisher is propelled forward, the strike-off is aided by a back-and-forth rotation of the cylinders, accomplished by means of a horizontal oscillating arm connected individually with the piston shafts.

This machine was put into service late in August and worked through the autumn. It has been aided by careful spreading so that very little concrete rolls up in front of the cylinders. Behind the machine, finishing manipulation is kept to a minimum, the bulk of the work being done with long handled floats as on the transitions. The use of air entrained cement was justified for it entirely eliminated the necessity of admixtures originally used to secure workability of concrete with a low slump. No bleeding was ever encountered on the highest super-elevation.

Checking Curved Surface

As with warped sections, extra inspection personnel was provided to check surface accuracy. It can be seen that the surface along upper lanes around the circle would be curved both transversely and longitudinally. Only an arc line along the



★ Above: Curved checking template, specially designed and built for checking the convex upper lanes of the turns

★ The strike-off contour was adjusted by moving individual settings of pistons mounted in a row

★ (Right to left): J. Albion, supervising field engineer for contractor; S. J. Dalzell, supervising field engineer for Packard; R. G. Heinrich, mechanical engineer for Packard; F. Painter, consulting engineer for Packard; E. Pacey, secretary to manager, Field Buildings and Real Estate, Packard

★ Handy runabout tractor and cart for clean-up work, hauling of tools, joint materials, etc.

★ Porath's grease truck—a converted Army 6 x 6

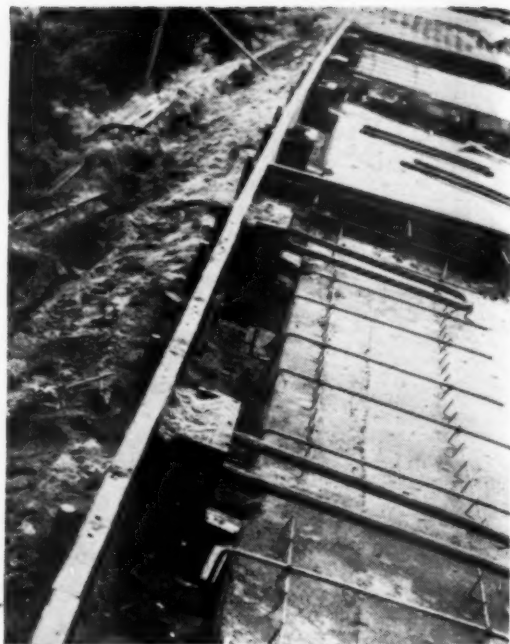


★ The checking template in use. (Right) below how dummy longitudinal joint was cut on curves





★ (Left): On the transition, each transverse header board cut to a different contour. Careful checking and re-checking was necessary to assure a perfectly warped pavement. (Right): Details of heavy U-bars whose threaded ends were left exposed in slots in the new slab for fastening the steel fence posts. Slots formed by sand-filled wood boxes as shown. Note new outer form is 9 in. beyond old outer slab edge on the turns. Light stirrup bars are for reinforcing the drop section of the new slab.



surface parallel to the circular centerline would be on a straight horizontal grade, but the curvature on a quarter-mile radius was so small when subtended by a 10 ft. chord that it was entirely practicable to use 10 ft. straightedges with long handles to check the longitudinal surface.

The novel solution devised by the Packard engineers for checking the transverse cross-section was the construction of an "A" frame truss to whose bottom chord there was attached tubing curved to the exact shape of the pavement surface. The entire frame was electric welded of 5/8-in. light wall tubing.

During the work progress this tem-

plate was hung from a movable bridge located immediately following the hand floating operation where continual checks were made of the transverse section. Following completion of each day's work, the template was transported by special trailers to the proving grounds garage, cleaned and checked on the master template for any distortion and readied for the next day's work.

Paver on Earth Terrace

Getting concrete "up there" with the paver was another problem. In spite of the high super-elevation, the contractor has succeeded in placing concrete around the outer lane of the

curve with a standard 34-E dual paver. This is made possible by two tricks. Along the transitions as well as the full circles he is building up a terrace in advance of the paver by trucking earth onto the previously paved inner lanes. This terrace provides a level paver path several feet higher than the pavement beneath, and the earth is conveniently available afterward for the curing cover. However, the paver still had to deposit concrete at a higher boom angle than that for which it was designed. A special hoist drum mounted on the paver holds the boom to the necessary angle.

Variable Mesh Reinforcement

Four weights of wire mesh reinforcement, all with 6 x 6 in. spacing, were specified for different sections of the track: light mesh on the straightaways, 42 lb.; a heavier (No. 4) wire on 6 x 6 centers for the inner lane on turns, 48 lb.; No. 4 x No. 3 wire on the next two lanes on turns; and No. 4 x No. 0 wire on the high side of turns. The Packard engineers recognize that many unknown factors will be present to affect pavement stresses on the curves, and heavy enough mesh is present to afford some degree of "beam reinforcement" in event unusual stresses develop during construction or later.

Dummy Joints Machined

The Packard engineers have given special attention to the joint finish-



★ Earth curing cover was kept wet with a specially equipped sprinkler truck, having a pressure spray bar along one side as shown. Throws water 30 ft. easily

ing job. A poured rubber seal is being used. Before sealing, all joints are blown out with compressed air, using a large portable compressor. Wherever joints are not properly formed in construction, ¼-in. wide joint grooves are cut to a depth of 2½ in. using a power grinding wheel. Grinding is done with a portable compressed air skillsaw outfit, considered necessary to insure an accurate, smooth grinder operation.

The pavement clean-up job includes a thorough going over with a power broom. The sealing outfit follows closely behind the grinder, and again care is taken to avoid over filling of joints. Preformed asphalt impregnated paper joint strips are being used to form the transverse and longitudinal keyways. The upper lip of this

strip is pulled away before the other side of a transverse joint is poured, so as to leave a clear pocket for cleaning or machining a surface groove ¼ in. wide to receive the seal. The project includes reproduction of the steel guard rail along the outer pavement edge. The new guard rail consists of steel H-posts at 7 ft. 9 in. intervals. Posts are anchored to heavy U-bolts protruding from notches in the pavement edge. New threaded U-bolts of 1½ in. diameter are set in place and held during concreting by a combination of wires and small wood blocks. One of the photographs shows these bolts in place along the upper edge of a transition.

The Packard Proving Grounds restoration was designed and supervised by the personnel of Packard's Field

Buildings & Real Estate Department, R. A. Stougaard, Manager. Mr. Frank Bornor served as the consulting engineer, having prior knowledge of the work through his position as engineer-superintendent on the original construction. S. J. Dalzell and Ray G. Heinrich served Packard in the respective capacities as supervising field engineer and mechanical engineer. Michigan State Highway Department standard specifications have been followed for many details of the project and highway department engineers consulted on certain phases of design and control. Carl Krueger, Vice-President and General Manager, and S. Albion, Engineer Superintendent, officiated for Julius Porath & Son Co.

ARBA Executive Meeting

Directors and executives of various branches of the American Road Builders' Association met recently at Pensacola, Florida, to formulate plans for the coming annual meeting. The big meeting is to be held February 17-21 at the Palmer House, Chicago.

Under the direction of engineer-manager Charles M. Upham the engineering, contractor and manufacturer divisions held sessions on problems and plans for the general meeting. In spite of postponement of the machinery show to 1948, the coming meeting promises to be one of the largest, most significant in ARBA history.

After the business sessions, Charles Smith, of Smith Engineering and Construction Company, acted as host on golf and fishing expeditions. The Navy also was host to the group on an inspection tour of the aircraft carrier Saipen, where the accompanying photo was taken.

Seen in the photo, kneeling in first row (left to right) are:

Ray McLean, Columbus, Ohio; Tom Pace, Pensacola; Maj. George Littlefield of Eglin Field; A. O. Cuthbert, of Lansing, Mich.; O. J. Semmes, Pensacola; Burton Miller, of Washington, D. C.; S. J. Mahaffey, of Richmond, Va.; R. H. Schmidt, of Clintonville, Wis.; W. J. Mann, of Raleigh, N. C.; Elgin Bayless, chairman of the Florida road department, Tallahassee; Senator Robert Swift, of Alabama; Judge Gilbert Smith, of Anson, Texas; Walter Toebe, of Lansing, Mich.

Second row (left to right) are B. F. Devine, of Milwaukee; Edward Porath, of Detroit; Donald O. White, of Chicago; W. J. Noonan, Pensacola; Capt. Crennelin; Edward S. Gillette, Chicago; William Ray, Pensacola; Carl G. Rose, of Ocala; Arthur A. Levison, of Pittsburgh, Pa.; R. E. Springer, of Pennsylvania.

Standing are Henry Johnson; T. A. Morrow, of Cleveland, Ohio; Willard Jennison, of Pensacola; Cliff Johnson, of Pensacola; Warren deBra, of Pensacola; F. E. Mitchell, of Valparaiso; W. G. Pruett, of Mont-

gomery; Charles M. Upham, of Washington, D. C.; Richard Pace; E. N. Rodgers of Montgomery; H. P. Coloney, of Tallahassee; L. W. York; R. K. Stiles, of Aurora, Ill.; Eugene Hines, of Greenwood, S. C.; Kenneth Lindsay, of Cedar Rapids, Iowa; L. W. Edison, of Grand Rapids, Mich.; W. A. May, of Mississippi; J. T. Calloway, of Chicago.

L. G. Schraub, of Kansas City; Keith Williams, of Pensacola; W. A. Young, of Macon, Ga.; James J. Skelly, president of the association, Media, Pa.; Paul B. Rynning, of Medford, Oregon; C. C. Crowell, of Nashville, Tenn.; H. R. Meeker, of Indianapolis, Ind.; W. E. Miles, Cleveland, Ohio; John A. Long, of Tallahassee; Edward McAdam; R. L. Bannerman, of Tallahassee; T. G. Soper, of Chicago; Frontis Sherrill, of Pensacola; Charles Smith; E. E. Hoebel, of Madison, Wis.; A. E. O'Brien, of Harrisburg, Pa.; George Malone, of Pensacola; W. R. Galvin; A. R. Taylor, of Pittsburgh, Pa.; Mr. Chapman; and Henry N. Schram, of West Chester, Pa.





Construction Scenes on Lift Bridge. See opposite page

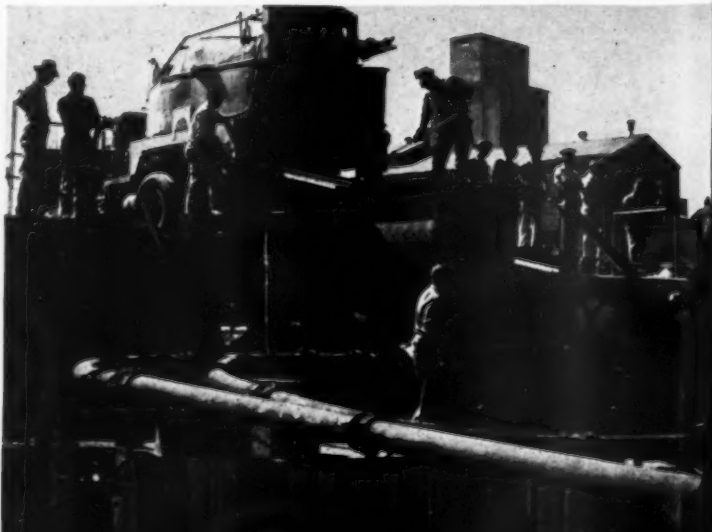
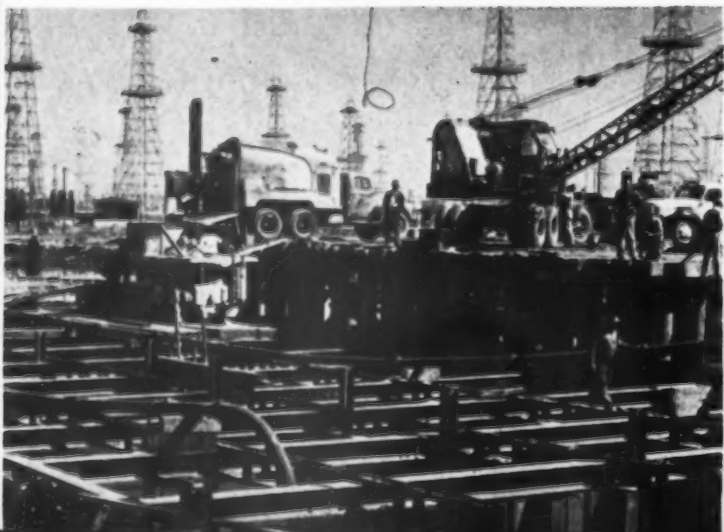
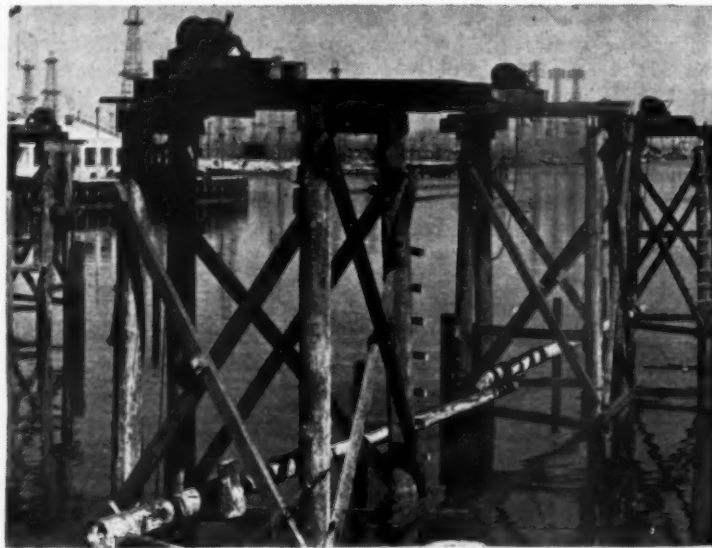
★ Placing of the tremie concrete core inside the double sheet pile sections of the bulkhead at one of the channel piers

★ (Upper left): The cofferdam, which was sealed at about minus—50 ft., was braced with three tiers of framing, consisting of lengths of H-beams from pile stock. The salvagable top tier shown and next frame down were made up of single H's, while the lower tier members consisted of four H-beams riveted together. Longitudinal bracing was made up of pairs of channel iron, as shown

★ (Upper right): The lower cofferdam bracing system for each tower pier weighed about 200 tons. Frames were fabricated and lowered to landing piles, without dewatering, by means of six dollies mounted on falsework pile platforms. The dollies were located in two rows of three, only one row being fully pictured here

★ (Lower left): General view of 60 x 120 ft. of cofferdam in place and seal being concreted, south tower pier. MG 32 sheeting of 52-lb. section used

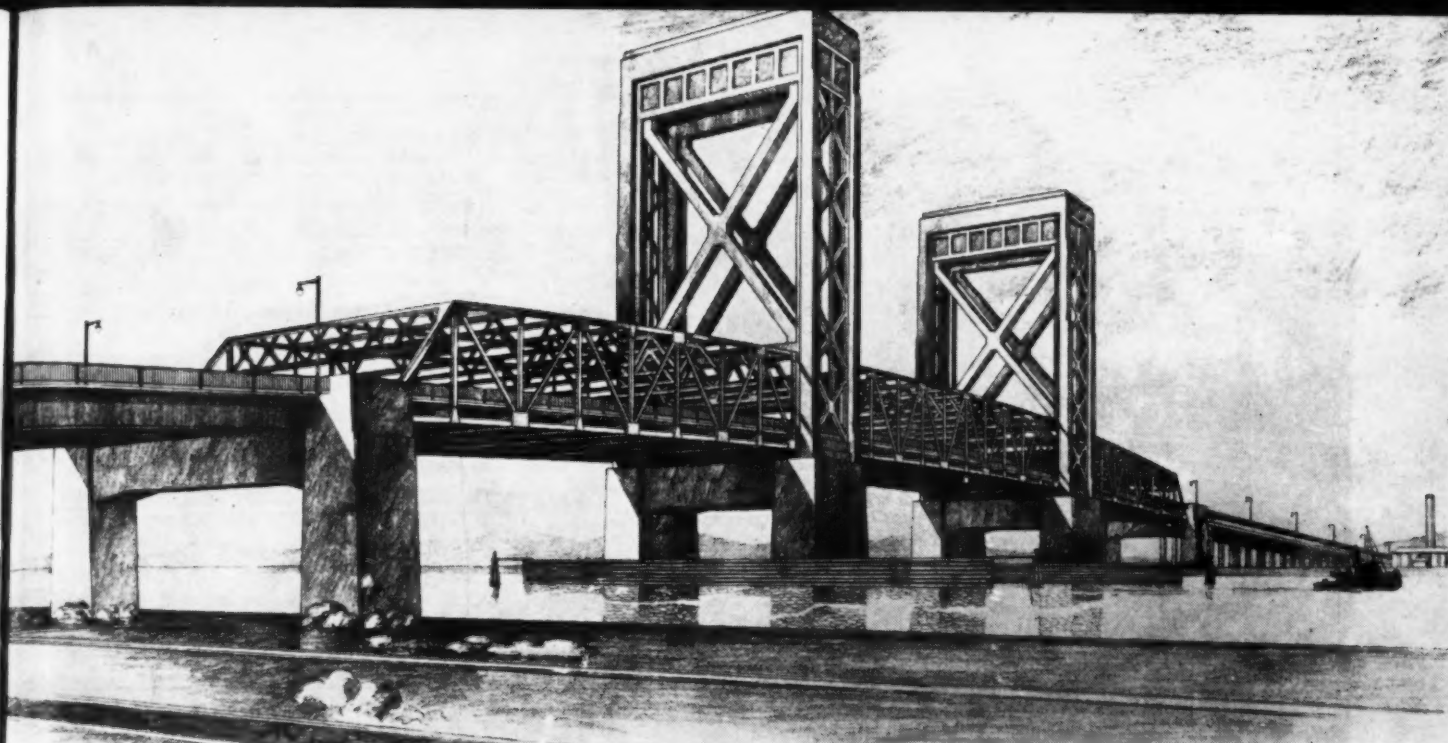
★ (Lower right): Electrically operated concrete pumping equipment, with two lines of 8-in. pipe was employed to tremie the seal concrete into place. An extra-rich (6-bag) mix was decided upon for the 10-ft. thickness of seal. Concrete was delivered ready mixed. Concrete delivery pipe and tremie equipment were handled with a floating goose-neck crane



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800-ton Vertical Lift Span

Design features and also some of the construction methods used in getting started on West's largest current highway bridge project

Cerritos Channel bridge in Port of Los Angeles area is part of new Terminal Island Access Freeway. The 3976-ft., 6-lane structure was designed by California Division of Highways; U. S. Navy handling construction; \$5,330,000 contract held by United Concrete Pipe Corp. and Ralph A. Bell, general contractors.

FOR more reasons than one, engineers and contractors are watching with special interest the construction of the new modern lift bridge over Cerritos Channel, in the Los Angeles harbor area now under Navy Bureau of Yards and Docks contract. The design represents the latest refinement in structures of its kind. The contractors and sub-contractors have been called upon to utilize interesting methods in the face of the unsatisfactory labor and material situation.

And from the standpoint of the planners, the bridge is of extreme importance in that it will eliminate a

grave bottleneck that existed all through the war at the entrance to the Naval Base at Terminal Island. Heretofore the only access to this huge establishment has been over an inadequately developed route including an old swing span over Cerritos Channel.

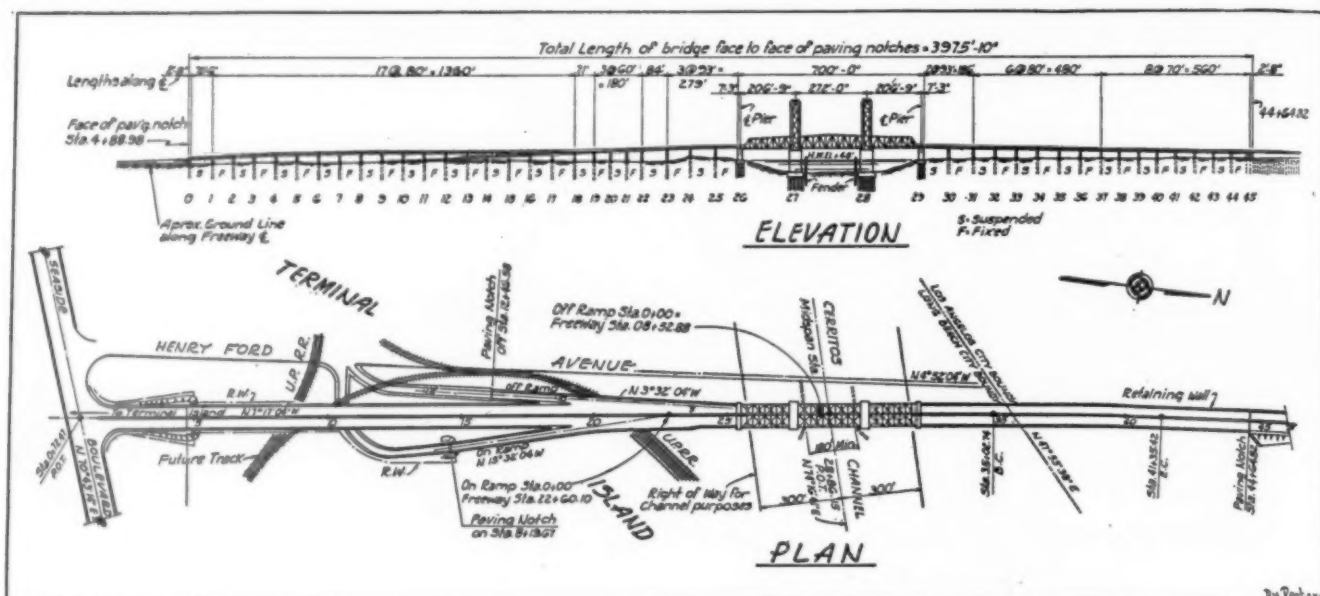
The text that follows will describe briefly the cooperative effort involved in the planning and design of the bridge as part of the new Terminal Island Access Freeway, which will eventually link Terminal Island with central Los Angeles and form part of the unprecedented network of expressway scheduled for greater Los Angeles. We will also outline the design of the structure, notably the lift span, and by picture and caption show a few of the methods observed in the earlier construction phases.

Decade of Planning

The present project is the outcome of studies begun a decade ago by the state's Los Angeles district highway

staff. The object was eventually to tie in the extensive harbor, industrial and oil field development with all main highways of the area. The project, vital as it seemed, was tabled during the war, and naturally one of the first steps taken by local Naval authorities after V-J Day was to recommend its early construction. The Bureau of Yards and Docks authorized the expenditure, and plans and specifications were drawn by the California state highway bridge department after extensive joint study by Capt. H. E. Wilson (CEC), USN, Public Works Officer at the U. S. Naval Base, Terminal Island, S. V. Cortelyou, state highway district engineer, and F. W. Panhorst, state bridge engineer. Contract was awarded to United Concrete Pipe Corp. on their low bid of \$5,331,500.

The bridge project is part of a 3.7-mile section of the Terminal Island Access Freeway for which several roadway and bridge contracts on to the north have also been let by the



★ Forty-one approach spans will flank the three channel spans



★ A 2½-yd. clamshell crane on a barge excavated the four channel pier cofferdams.



★ Spray bar (arrow) set up curing of approach footing

California division of highways. All the cost of design and construction is borne jointly by the Navy Department and the Federal Public Roads Administration; the Navy has allocated \$10,000,000 and the PRA \$4,000,000 for accomplishment of the complete Freeway Project. Upon completion and acceptance of construction work, the cities of Los Angeles and Long Beach will maintain the Freeway development including this bridge.

The bridge comprises three channel spans of 206 ft. 9 in., 272 ft. 0 in., and 206 ft. 9 in. center to center of piers, and forty-two 80-ft. approach spans. The three channel spans will consist of sub-divided Warren type through trusses with split panel points. The approaches are of articulated steel plate girder construction with alternating fixed and suspended spans. All approach bents will have reinforced concrete columns.

Following state highway standards in structural design, the bridge will provide two 35-ft. roadways divided by a 5-ft. median strip, and two 4-ft. sidewalks for the maintenance crew (no pedestrians to be allowed).

An open steel grid floor is specified for the lift span. It is to consist of 5-in. standard grid units in a system which will provide for extremely heavy traffic use, yet weigh only about 19 lb. per sq. ft., the grating itself weighing 12.8 lb.

Span Raises 125 Ft.

The lift span will be 240 ft. between bearings, which makes it probably the longest of its type in the West. The span is designed to have a channel clearance of 50 ft. when down and 175 ft. when fully raised and in normal service. The contractor is required to maintain a 40 x 40 ft. passage during construction.

Towers and piers are designed with thought to pleasing appearance as well as to high factors of strength and stability against fire and earthquakes. Towers are each 163' 3" wide by 34' 10" through and 240 ft. high above high water. Tower legs are of 4 x 6 ft. box girder design.

Abutment and tower piers (26 to 29) will be of massive, hollow, two-column design, the tower piers being 102 ft. high from top of footings. Pier top dimensions are equally impressive, being 109 x 20.5 ft. and 110 x 38 ft. for side span piers and tower piers, respectively.

Tower piers will rest on H-pile-supported footings 15 ft. thick; 390 piles for each 118 by 59 ft. footing block. Approach span bents have treated timber piling.

Every type of modern control and operating feature will be provided for the lift span, including traffic gates, barriers and lights, and signals and controls for regulating both deck



★ A truck-mounted clam excavated for approach footings and performed general clean-up and lifting of form panels

and river traffic.

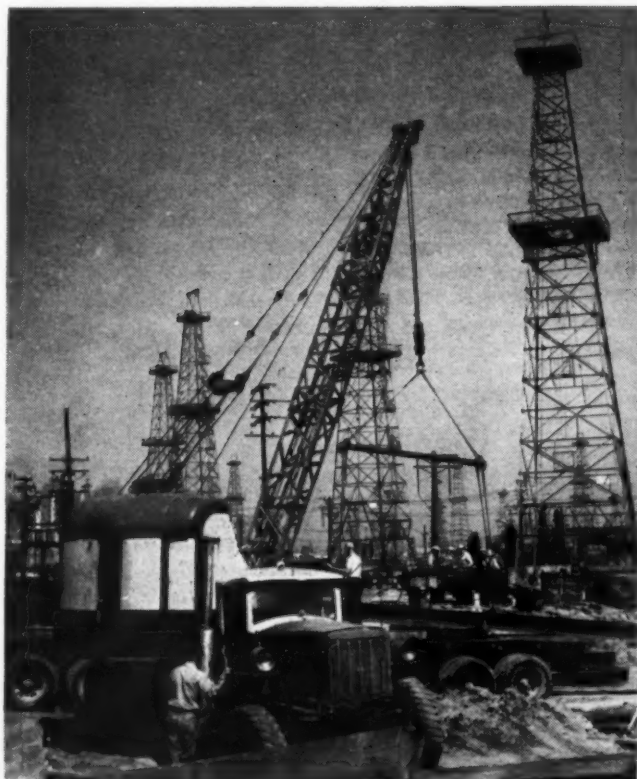
Longitudinal and lateral control of the lift span during raising or lowering are to be provided by steel guides and rollers concealed in the tower frame-work and under the cladding plates. The span comes to rest notched over 6-in. square pins at each corner, as a guide to support on cast steel shoes, with 1/2-in. play controlled by the guide rollers.

Operating Mechanism

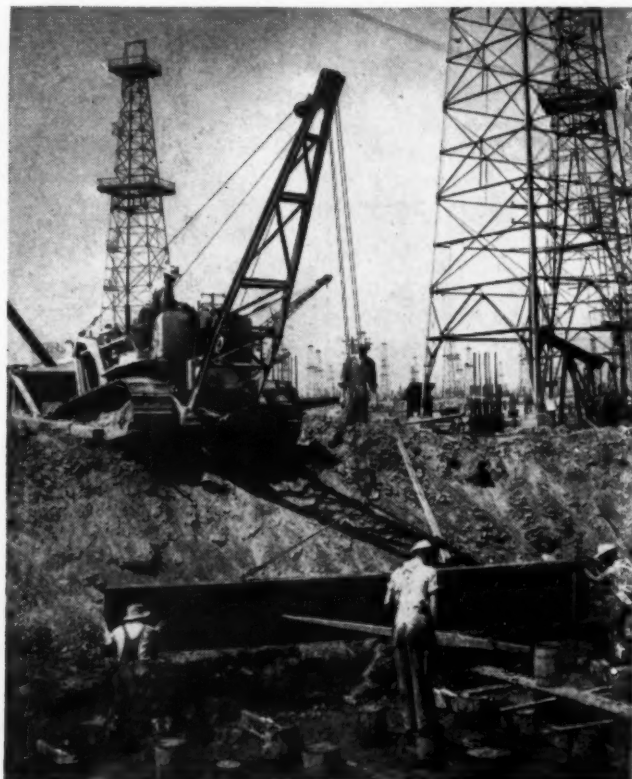
The design for the center-balanced life mechanism originally called for two 100-hp. electric motors on each

tower—450-v. units operating under the Saltz system, both motors starting the span in motion and one motor then cutting out automatically and acting as an equalizer during motion. The motor system is understood to be in process of re-design to use roller bearings to cut down power requirement.

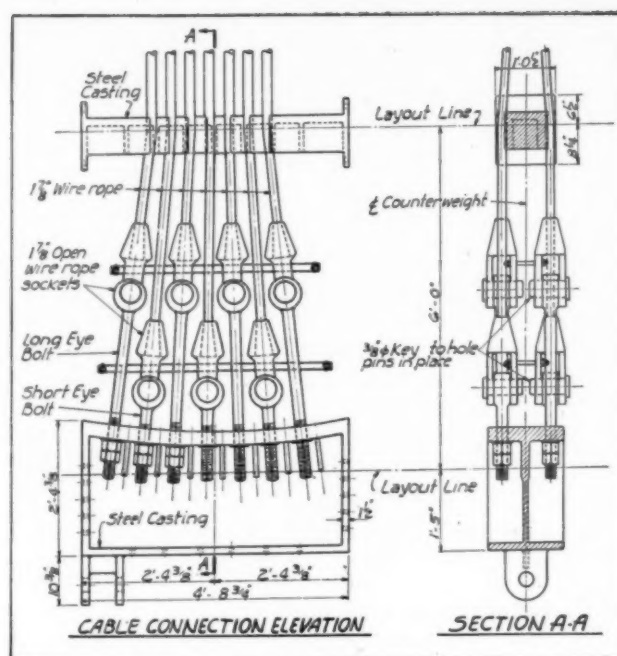
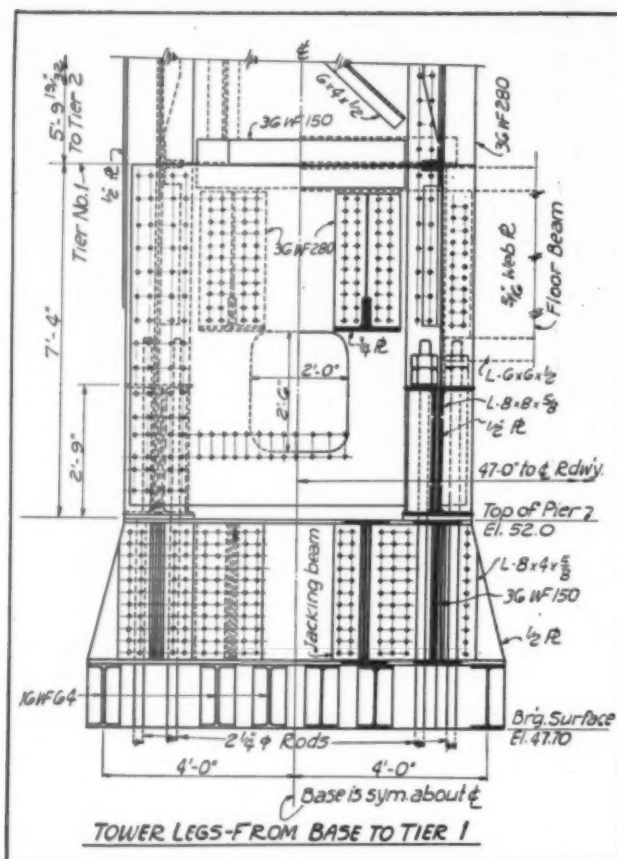
The span and counter-weight are to be supported at each pier by fourteen 1 1/2-in. steel cables passing in a row over a sheave. The lift is estimated at 210 tons for each corner, and 220,000 psi. steel is specified for the cable. Cables must not elongate



★ Several truck-mounted cranes handled the long H-piles at the rail siding, splicing yard and bridge site



★ One of the most valuable machines on the job—rear boom on a tractor



★ Cable connection elevation

★ Details of tower legs

more than 2% in any 10 ft. of length to meet requirements. Each cable will consist of nineteen 6-strand load carrying wires, six spacer wires and a hemp center.

The counter-weight will consist of Navy class D concrete of estimated 86' x 10' 2" x 6' 8.5" dimensions with steel supporting trusses.

The bridge will be operated from a fireproof modern control room so located that the operator has a clear view of both roadway and river traffic. Each tower will have a hydraulic ele-

vator for crew use.

Approach Piers Construction

The 25 approach piers to the south were started first. The large number of piers of approximately similar design but graduated height permitted some planning of forming sequences to save labor and lumber. A small clamshell excavated for footings. Because of the soft, powdery alluvial soil, which offered poor going for equipment either wet or dry, a crawler tractor outfit with rear boom and

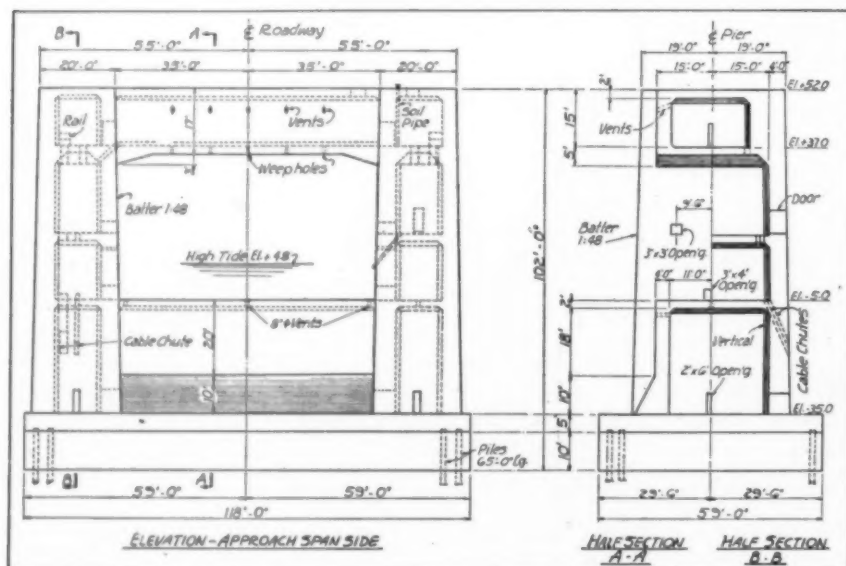
hoist was used to speed up form handling for footings and lower lifts. Truck cranes handled forms on longer move-ups and where higher setting elevations were involved.

Four sets of forms 27' 6" high were employed for piers 1 to 9, inclusive, and four sets 31' 8" height for piers 10 to 19. Another four sets of forms were made up for the on and off ramp piers of special design, and four sets for all 4-ft. diam. columns involved on the project. Some study was given by the contractor to the use of special steel forms, but it was found that wood forms cost less. The government supplied some lumber, and big rough dimension timbers were sawed to supply some of the footage.

Notes on Concrete Methods

Rigid control specifications for the quality of the structural concrete have been set up for the project. All concrete is to be internally vibrated. Water curing is used for concrete exposed to sea water and for large masses; curing compound may be used for other locations. An item in Navy practice seen here is the requirement that the top layer of footing concrete, after striking off and allowing concrete to stiffen slightly, must be scraped or blown away, to

★ Elevation of tower pier. (Approach span side)





★ This "Y" type spray bar was built by the contractor to use in spraying a combination of compressed air and water under high nozzle pressure. Purpose: to speedily remove laitance from footing tops, in compliance with state specifications, compressor at right being rigged up for this task

remove any laitance that might hinder bond with the pier superstructure. The contractor speeded this chore and eliminated much concrete finish labor by rigging up a blow pipe (see photo). A combination of compressed air and water spray is shot through the pipe from a Y connection, furnishing a blast which enabled one man to peel surface scum away in short order.

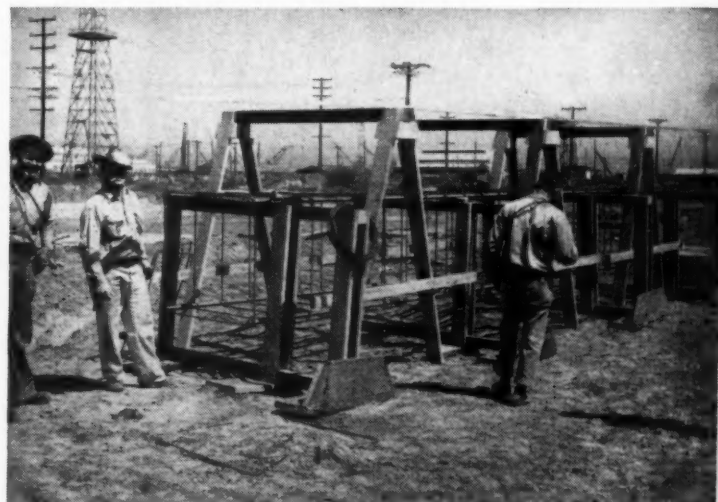
Underwater Pile Cut-off

All channel piles were placed during the past summer using three pile driving outfits. Driving of steel H-piles of sufficient length to get good bearing entailed butt-splicing, which was done at a yard a quarter-mile from the site using three arc welding outfits. Piles for shore abutments required up to 90 ft. of length, and

these were cut off at minus 5 ft. Tower pier piling was about 65 ft. long, with cut-off at minus 50 ft. Piles were easily handled in lengths up to 90 ft. with truck cranes and trailers. Shore abutment piles were set with regular leads and driven to the waterline using a McKiernan-Terry 11B-3 hammer. Special telescope leads and a 15,000-lb. Vulcan 50-C hammer were



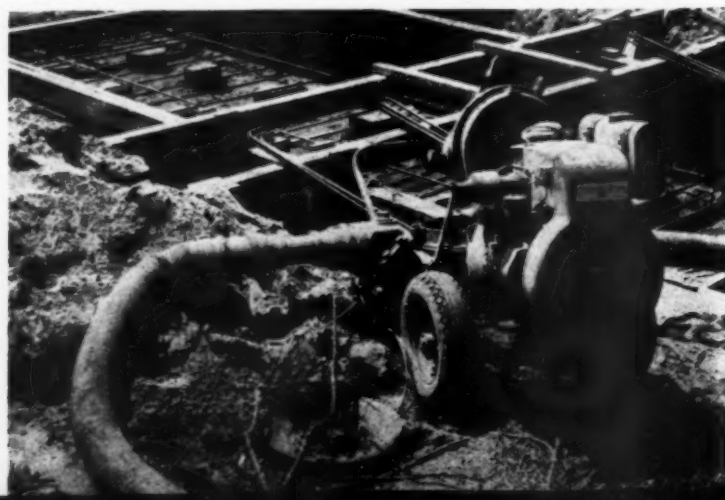
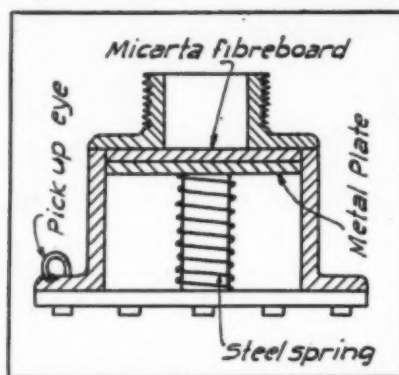
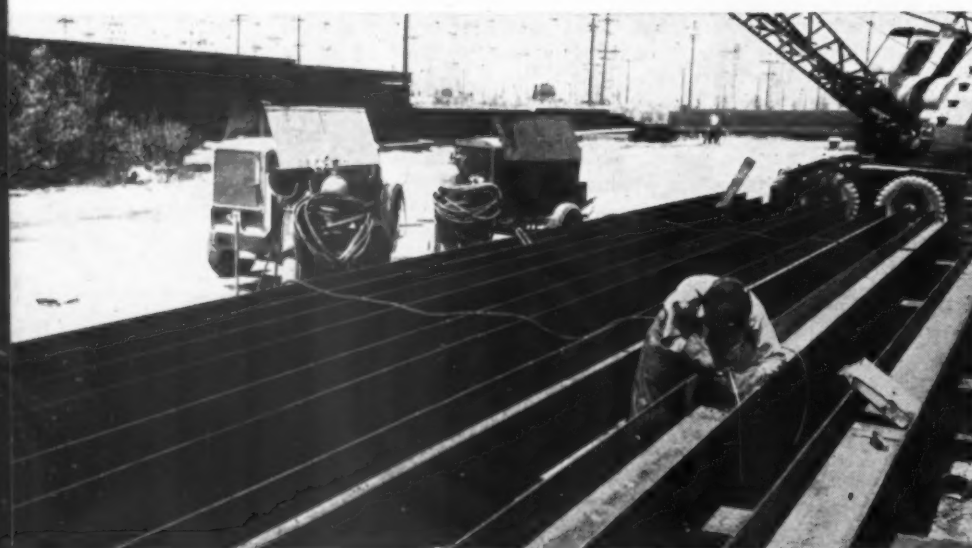
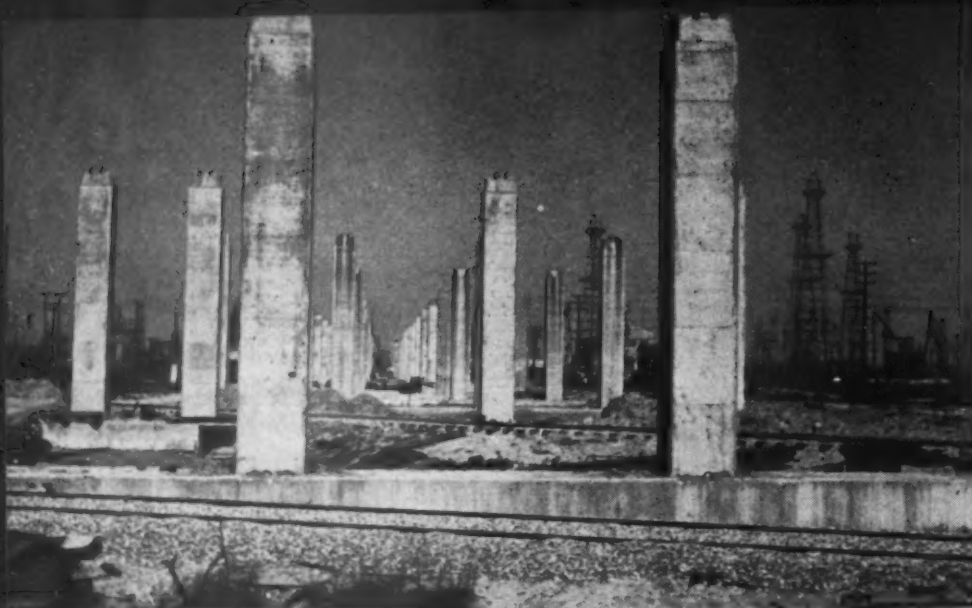
★ At the saw table, approach pier form construction



★ Another labor saver—template for fabricating pier column reinforcement

★ (Left): Note heavy reinforcement in this typical approach footing, for two-column open pier. Designed with earthquake factor. (Right): An interesting reinforcement detail at base of approach pier column. Footing concrete was deposited with a drop bucket and internally vibrated.





★ Waiting for deck steel—a sign of the times

★ (Lower left): Heavy H-piles were butt-welded in 65 and 90 ft. lengths for channel pier foundations

employed in driving tower pier piles to minus 40.

An unusual detail in under-water driving consisted of a special pile head exhaust valve, designed and built by the piling subcontractor, Proctor & Kuhn. Whereas the usual under-water driving custom is to exhaust steam through a pipe or hose leading to the surface, exhaust was effected with a spring valve. The details are shown in the accompanying sketch and photo.

Channel piers are being built in open cofferdams, which were excavated by a 2½-yd. clamshell working from a barge. Seal will be at about minus 50 ft. and no unusual difficulties are expected.

Structural Steel Details

Trusses and towers are to be fully assembled in the fabricating shops. Beams making up the columns are also to be shop assembled sections and splices riveted before milling. Following accepted practice, truss members will be accurately blocked to the correct camber until all tension chords are fully spliced and riveted and truss connection pins and bolts

★ (Left): Special valve devised for under-water exhaust in connection with under-water pile driving (also see sketch)

★ (Right): Cross section of special spring type exhaust valve, designed and built by Kuhn & Proctor for under-water pile driving

★ (Lower left): Field repairs in progress on one of the pile hammers. Two hand-operated hydraulic jacks were used to force the critter

★ (Lower right): Modern pumps and plenty of capacity — another detail which kept footing work on schedule

are in place. It is expected that the lift span will be erected in position. In a later article **ROADS AND STREETS** expects to cover this phase in detail.

Acknowledgments

Under the general contract held by United Concrete Pipe Corp. and Ralph A. Bell, Columbia Steel Co. representing American Bridge Co. is fabricating and erecting the steel, which will total 12,000 tons. Proctor & Kuhn has a sub-contract for driving steel H-piles and building cofferdams for the channel pier foundations. Reinforcing steel for concrete approach spans is being furnished and fabricated by A. C. Meehlis. The entire concrete yardage is being furnished ready mixed by Consolidated Rock Products Corp., aided by a fleet of modern 4-yd. trucks.

Representatives of the Navy's Bureau of Yards and Docks are Captain H. E. Wilson (CEC) USN, Officer-in-Charge of Construction for the Naval Base, and Commander J. W. Frorath (CEC) USN, Project Manager for the Access Freeway. United Concrete Pipe Corp.'s field superintendent is Milton C. Shedd.

New Jersey Expands Planning Functions

In line with the growing emphasis on the economic and functional problems in highway engineering the New Jersey state highway department has set up a division of planning and economics. In response to a query, Sigvald Johannesson, its director, has written us as follows:

"The new division was created because the highway department was in need of a centralized office to co-ordinate its work and to make use of the data collected by the Planning Survey. It is divided into two bureaus, namely, the bureau of planning survey, which collects the various data pertaining to highways and the use of them, and the bureau of planning and economics, the scope of which is outlined below.

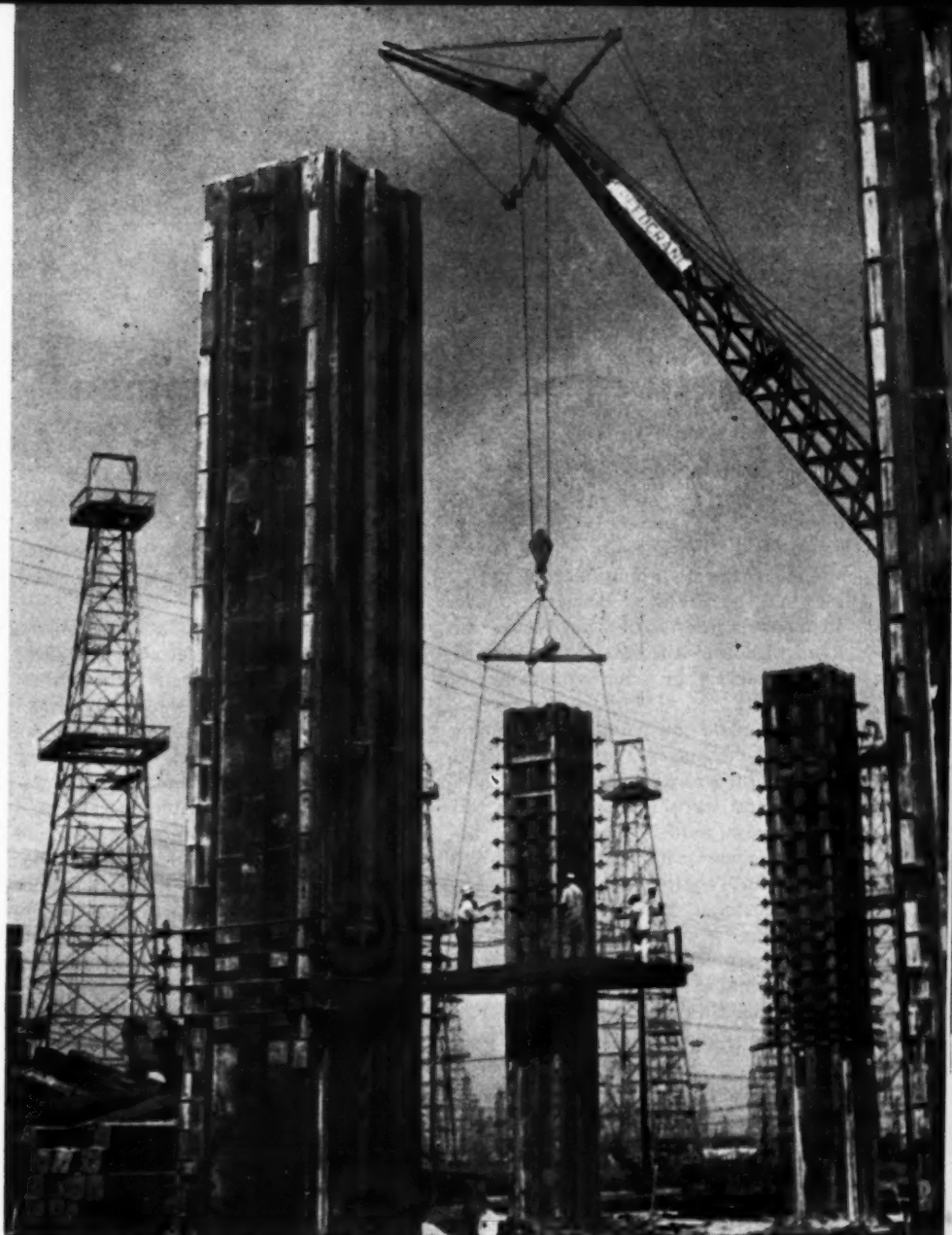
"1. Study and prepare a long range program for development of New Jersey's state highway system based on present observed needs and traffic trends, and on probable future evolution.

"2. Prepare a continual 5-year program of state highway construction and reconstruction based on priority of need.

"3. Establish the priority of need by factual data obtained from highway planning survey and elsewhere.

"4. Prepare an annual program of state highway construction and reconstruction.

"5. Provide factual data to sup-



★ A 70-ft. mobile crane with 20-ft. extension was used thusly to expedite the disconnection and removal of pier column forms, north approach

port the annual program in order that the highway commissioner, the governor and the legislature may have the essential facts leading to the selection of the annual program.

"6. Prepare program of the Federal Aid primary, secondary, urban and interstate systems of highways in New Jersey, conforming to laws of Congress and to needs of the state. Extend and amend this program as future developments may require.

"7. Study highway developments in the state proposed by local and civic agencies and prepare reports thereon, based on factual data and conditions.

"8. Study and report on state and federal legislative bills affecting highways in New Jersey in their relation to the economic development and use of all highways in the state.

"9. Study and report on other projects affecting highways and high-

way developments.

"10. Prepare economic analysis of contemplated routes.

"11. Procure, analyze and provide factual data for determination of location of traffic interchanges.

"12. Provide traffic flow data for design of traffic interchanges.

"13. Assemble pertinent information relating to highways for dissemination to and use by bureaus of the Highway Department and other agencies.

"14. Perform miscellaneous investigations and prepare reports.

"15. Contact with the division of planning and engineering of the department of economic development and other public and civic agencies.

"16. Economic analysis and study of truck loadings, weights and dimensions and their relation to pavements.

"17. Study road users' tax structure."

★ Better Road Building Equipment

The other day a room-full of men got together for two days in Washington. Their subject was highway equipment, where we are and what we need. It was a long overdue meeting, and the Highway Research Board in cooperation with the American Road Builders' Association, performed a real service in bringing the meeting about.

What made the meeting significant is that engineers, contractors and manufacturers were there together. The latter were present not to tell about new models particularly, although some were discussed, but to hear what equipment users had on their chests.

Cutting through the welter of detailed equipment problems introduced, we can make several broad observations from this meeting.

One is that manufacturers in general are on their toes. Their engineers know more about road building theory, as applied generally, than a lot of highway engineers. Their perennial problem is to get engineers to make up their minds what they want or don't want. In this big country some engineer is always coming up with a mechanical suggestion which the manufacturer has long since tried and discarded. While sincerely on the lookout for real innovations, the manufacturer must finally cut the frills and variations and settle on standard designs that will find sufficient customers to spread his costs and permit reasonable prices.

That in turn focuses again on the relationship between the engineer and the contractor. The contractor, who finally has to pitch in and do the work, has shown a better ability to make up his mind on what equipment he wants than the engineer. To take one example, engineers have not done too excellent a job in making up their minds whether they do or don't want vibration, or how to vibrate or where or how much, or what equipment will be permitted. This goes for soil as well as surface construction. Finishing machine details and many other

matters where the specifications try to specify or limit the method as well as decree the result were aired. The old cry of the manufacturer was again heard, "Tell us what you want and we'll build it."

Another point made is that even the best equipment may let someone down for lack of proper use rather than because it needs re-designing. Road forms are a case in point. Considerable discussion was given to this big item in the paving contractor's capital investment. Why do concrete road forms sag or spread in spots and lead to an uneven concrete surface? Because they need to be of costly battleship construction instead of quarter-inch steel or less? No. The trouble more often is lack of proper bearing and anchorage. Better preparation of the grade and bearing under the forms is a detail for the inspector to watch, and use of 30 or 36-in. form pins should be considered more often in preference to 18-in. pins.

Which leads to a third point, and that is the human element which will never be anything but first in road building however perfect the mechanization. As an example here,

in ordinary bituminous plant operation, chances for human error or variation in mix control occur in a half dozen or more places. The cost of providing fancy electric-eye or other controls is prohibitive. Though latest plant design has greatly improved the accuracy of control, much still depends on the operators. Still unsolved is a practical program within the industry for training operators. Men who run pavers, bulldozers, scrapers, graders, rollers and scores of other modern units have a part to play that has heretofore been underestimated. With the passage of time these men develop great skill in working levers, but that isn't enough. They need to know what the engineer is trying to get accomplished. Being practical men rather than students, their problem calls for "show-how" rather than text-book training. It seems to us that the larger highway departments could profitably set up a department whose job is to get contractor men together with inspectors and field engineers for visual demonstrations of methods as they effect grading and paving quality.

★ Specifications and Modern Equipment

Sometimes a revision of road specifications will work toward the more ready utilization of modern equipment. As an example, the specifications of one state on bituminous work make a special condition of the use of a traveling plant. They say that "if the contractor elects to use a traveling plant he may do so provided he makes a written request for the use of this type of equipment and the request is approved in writing by the engineer." The clause stating

this condition comes along in these particular specifications following a long description of blade or road mix methods.

Travel-plant and hot-mix construction have come to the fore in the past decade, taking on at least equal importance with blade manipulation in many states since their current specifications were written. A modern highway department should keep up with new developments and the one referred to here is an outstanding

leader in this respect. Specifications also must keep up with the times and we are glad to note that a number

of states, counties and cities have recently combed over their documents or plan to do so soon.

★ Pavement Markers—Who's Right?

A dozen bewildering schemes of pavement marking continue to have their advocates in the various state highway departments and whose system is the right one, the best one?

For over a year a Joint Committee has wrestled with the problem toward a set of standards that will lead to a national uniform way of striping our roads. Some highway departments are anticipating the proposals and adapting their methods to get in line. Other "rugged individual" departments are going ahead with announced plans to continue different methods, and carrying on correct-striping work accordingly. Are their systems the best and how do they know for sure?

Elsewhere in this issue, "Roads and Streets" reviews the latest developments and thinking on this controversial subject. In preparing this report the editor received by letter a great deal of interesting comment. Clearly much sound thinking has been given to the subject, and the state highway leaders are thoroughly aware of the safety value of good pavement marking. We have come a long way since the idea of striping the centerline was first advanced, it is said, by a Dr. June McCarroll, club woman of Indio, California, back in 1924.

But important as logical thinking is here, apparently such thinking is not alone able to prove that any one method is best. Perhaps no one system is markedly better than another. Certainly, any of several effective methods of marking, well kept up and enforced, is far superior to some other striping scheme where paint is faded and no-passing enforcement is lax.

In writing to us on the subject, one of the most persistent and telling crusaders we have for uniformity of marking, C. R. Waters of New York state, asked us, "Have you any suggestion that would help to bring about an agreement among the states?"

Yes, Mr. Waters, we have and it's one that I believe concurs with your ideas.

We have come to the conclusion that a dash line, properly proportioned, is satisfactory for marking the center line on two-lane pavements,

that a dash line should be used where traffic is allowed to cross freely, and a solid line should represent a place where crossing is restricted. At the present time about half of the other states use a dash line for the purpose indicated, and the other half use a solid line. If the states which use a solid line would join with those which use a dash line for center line and all of these would then use the solid line for the barrier line parallel to the dash line for "Release" and "No Passing" zones, it would not be long before uniformity throughout the United States would be accomplished. The color of these lines would then become a secondary

★ First of the Safety "E's"

As we start the new year it might be well to pause silently for a moment in contemplation of the thousands who have died or will die in highway accidents due largely to *faults of roadway design, maintenance, signing or pavement marking*.

With all due regard to the need for tough, intelligent, relentless enforcement and for programs of driver education and warning that penetrate clear to primary school classrooms (and corner barrooms), we must face the fact that the highway accident rate per hundred million vehicle miles of traffic flow—in other words, the average chance of a mishap with an average human being at the wheel—can gradually be reduced by the engineer and administrator. We are indebted to Charles M. Upham of ARBA for the challenging statement that a 76% reduction can be thus brought about in time. The tools are well known: separation of opposing traffic streams where justifiable . . . wide, stable, well-kept shoulders with room to park in emergency . . . control of commercial enterprises along the road . . . exclusion of pedestrians (and bicycles) from certain roads . . . roadway designs for proper speeds . . . specially designed entrance and exit lanes . . . these are the major tools.

Or are they the main ones? The tool kit also must hold such items as better guardrails, traffic control de-

consideration for determination later. But here again is an opinion needing scientific support. Why not set up scientific tests to determine which patterns and color are most clearly visible under all weather and lighting conditions; which system is most clearly understood; which phases of marking today, if any, cause definite confusion. Opinion polls among highway users would aid such an investigation, but the real results would be the findings of technicians in measuring reaction time of drivers, limits of visibility. As a beginning, studies and conclusions could be made as to whether a dash or solid line is really the best centerline of two-lane pavements outside restricted areas.

Men with honest opinions will get together and argue for years on this subject. Basic engineering data and other much needed yardstick data that they will recognize as sound may point to a conclusion that some one stripe system is definitely the best.

vices, intersection design, illumination. Surface texture is another subject. Researchers have a big unfinished job. In fact it can be said that their work is hardly begun, and both research time and the lag in application of findings must be shortened. Another one percent of the billion a year we're to spend for roads, or ten million dollars annually, would be little enough to set aside as a "raise" for the funds already available for safety investigation. Here would be one form of "diversion" no one could criticize.

Highway Traffic Reaches All-Time High

Travel on rural roads in September climbed to an all-time peak for that month, according to figures compiled by the Public Roads Administration from traffic records supplied by State highway departments. The previous September record, established in 1941, was surpassed by 2.7 per cent.

In the first three months of 1946, rural travel exceeded that of 1941, the pre-war peak year, by as much as 3 per cent, but this trend failed to continue during the spring and summer months when travel was from 1 to 6 per cent below 1941 levels.



★ New York State's method of marking restricted zones approaching hills, curves and intersections

NEEDED: Uniform Pavement Marking

Can states reconcile their differences? Here is the status after a year in which state highway departments struggled with paint and equipment shortages to catch up with the pavement re-stripping job neglected during the war. As this article goes to press, a Joint Committee is about to submit a proposed manual of national standard pavement markings to the states

By Harold J. McKeever
Editor ROADS AND STREETS

THIS past summer the Roads and Streets editors drove some forty thousand miles over the nation's highways. While at the wheel the writer, for one, became just plain John Q. Motorist, who is a good natured guy usually but given to griping at times. He gripes most frequently and explosively over congestion in and around towns and cities. But he also has a fancy list of secondary complaints, and high on the list is the lack of uniformity in pavement marking. Or lack of marking, period. It seems that in some states the center stripe and other paint lines that he has come to lean on mentally for comfort in this hazardous motor age,

①	②	③	④	⑤	⑥	⑦
White Center Line White Barrier Line	White Center Line Yellow Barrier Line	Black Center Line Yellow Barrier Line	Black or Yellow on Conc. White or Yellow on Mac. White or Yellow Barrier Line	White on Mac. Black on Conc. Yellow Barrier Line	Yellow Center Line White Barrier Line	Solid Center Line With Ditch for Barrier Line "
LOUISIANA RHODE ISLAND	NEVADA	ARKANSAS	GEORGIA	COLORADO ILLINOIS INDIANA KENTUCKY MISSISSIPPI NEBRASKA NEW MEXICO NORTH CAROLINA OHIO OKLAHOMA SOUTH DAKOTA TENNESSEE	OREGON UTAH WASHINGTON	TEXAS Asphalt and stone chips

have rubbed dim if not entirely disappeared.

Highway and street officials are now fully aware that effective striping is one of the most important keys to accident reduction. Realizing that something approaching national uniformity is urgently needed, interested organizations have been at work through a Joint Committee on Uniform Traffic Control Devices. The committee represents the AASHO, The Institute of Traffic Engineers, and the National Conference on Street and Highway Safety. A manual of recommended practice will eventually result, and it is planned soon to submit to the state highway departments a greatly revised Manual on Uniform Traffic Control Devices. On October 14 H. E. Hiltz, committee chairman and deputy commissioner of the Public Roads Administration, sent a lengthy memorandum to the states outlining the situation for discussion. While details of a proposed uniform practice have not at this writing been formally submitted to highway departments and municipalities, the committee's earlier findings have become generally known.

Meanwhile, several states have gone ahead with postwar remarking on the strength of advance information—notably California, which spent the season converting its striping system.

Striping Patterns Still Vary

Marking patterns and color schemes continue to vary between states. Following are excerpts from the October 14 PRA Memo: "The question concerns the marking of no-passing zones on two- and three-lane roads. In 1940 the American Association of State Highway Officials adopted a standard

specifying *white* or *black* center lines (or lane lines), with a *solid yellow* "barrier" line to the right of a normal center or lane line throughout a no-passing zone. The normal center or lane line, under this standard, might be of either solid or broken design.

"The AASHO standard has not yet been adopted in practice by even a majority of the States. A recent survey by Mr. Charles R. Waters of the New York State Department of Public Works indicates that 17 or 18 states use a yellow barrier line in connection with a white or black center line, while at least five others use the two-color scheme with a white barrier line and a yellow center line. Apparently at least a dozen states still do not use no-passing markings, or use markings that make no distinction as to direction of travel. These states are in a particularly favorable position to adopt whatever standards are now agreed upon.

"To what extent the failure to adopt the AASHO two-color standard is due to wartime shortages it is not possible to say. The War Emergency Edition of the Manual on Uniform Traffic Control Devices permitted the use of all-white no-passing markings, having explained, however, that 'the only factor necessitating a change in standards during the war emergency ***** is that certain paints, particularly yellow, contain materials that are or may become critical.'

"Recognizing the strong desire of some states for a 'one-color' system of marking no-passing zones, the committee at its meeting last December voted to accept such a system as an alternate to the AASHO two-color standard. The committee expressed preference for a white center line,

American highway users, in the interest of safe driving, deserve nationwide uniformity in pavement markings for highways and streets.

and for a barrier line of contrasting color (i.e., yellow, if with a white center line, or vice-versa) but left it optional whether one or two colors were used, and which color was used for either or both lines. The one-color system, however, requires that the distinction between center line and barrier line be made by type of line rather than by color. Hence the committee made a broken line *mandatory* for the center line, with a solid line mandatory for the barrier line."

Committee Proposal Criticized

This action, although acceptable to those states that desired a one-color system, and to those that favored a yellow center line, immediately was criticized on several grounds.

(1) It was definitely a movement away from a uniform standard in that it permitted either yellow or white or any combination thereof for the required striping.

(2) On the other hand, it stipulated that the center line should be of broken design in all cases. This was protested by many who claimed that (a) the broken line is difficult to apply properly, or that (b) a solid line is more effective as a traffic control device.

As a result of this criticism the question was reopened at the July meeting of the Joint Committee, and the Committee reversed its former action by reaffirming the existing

★ Tabulation showing method of marking center line and "No Passing" areas in the various states (and Ontario and Quebec). Compiled under direction of Charles R. Waters, District Engineer, New York State D. of P. W.

⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	⑱
Yellow Center Line Yellow Barrier Line	White Center Line Yellow Barrier Line	White on Mac. Black on Conc. Yellow Barrier Line	Yellow or Black on Conc. Yellow or White on Mac. Yellow Barrier Line	Black on Conc. Yellow on Mac. Yellow Barrier Line	Yellow Center Line White Barrier Line	White on Mac. Black on Conc. Black or White Barrier Line	White on Mac. Black on Conc. White Barrier Line	White Center Line White Barrier Line	Dash Line for Center Line	Single Solid Line
ND. DAKOTA WYOMING	ARIZONA MICHIGAN	MINNESOTA MISSOURI	ALABAMA	WISCONSIN	IDAHO MARYLAND	SO. CAROLINA	DELAWARE KANSAS	CALIFORNIA MAINE MASSACHUSETTS MONTANA NEW YORK PENNSYLVANIA VIRGINIA W. VIRGINIA PROVINCES OF ONTARIO & QUEBEC IN CANADA	VERMONT CONNECTICUT (Solid Line in No Passing Areas) FLORIDA (Use 1 Dash & Solid for 2)	NEW HAMPSHIRE (Yellow) NEW JERSEY (White) IOWA (Black or Yellow)



★ How Ohio marks a 3-lane arterial entering Columbus. The barrier is carried from one stripe diagonally to another over a summit

AASHO standard, with, however, an expressed "preference" for the broken center line.

This action, in turn, has been protested by the "one-color" states, including at least two states that adopted the one-color scheme in good faith on the basis of the committee's earlier recommendation.

Arguments made for the one-color system of marking no-passing zones, to continue with the PRA Memo, are:

1. Under certain not infrequent conditions of weather and light, a yellow line cannot be distinguished from a white line, hence any dependence on color contrast is unsound.

2. A broken line is as effective as a solid line for center and lane lines.

3. A broken line saves 60% or more in paint, without any considerable increase in the cost of application.

4. Equipment has been developed to lay down or to repaint broken lines accurately and neatly.

5. For lines of a single color, the painting equipment need have only one tank of paint, increasing its capacity and facilitating supply.

6. Using a single color, a line may be changed easily from a solid to broken type, and vice versa. This makes it practicable to substitute for the center line through no-passing zones a double line, of which one or both elements will be of solid design, depending on whether the zones in opposite directions overlap. With two colors it is necessary to continue the center line through the no-passing zone and place a line of another color on one or both sides, i.e., place a triple line where the zones overlap. The triple line occupies an unnecessary width of roadway and is accordingly exposed to undue wear. Or, if the double-line design is used with two colors, it is necessary to use four

paint guns in addition to the center-line gun, to permit changing colors at some point on each of the lines.

7. A broken line should, in any case, be used for the normal center line where passing is permitted, thus reserving the solid line for lines that are not to be crossed, particularly the barrier line.

8. Plain white lines are more pleasing in appearance than yellow or a combination of yellow and white.

9. There is no objection to the use of two colors by those states that prefer to use color contrast, provided the basic distinction in form between broken and solid lines is maintained. Thus the original two-color AASHO standard is still acceptable, except that a broken center line must be used.

10. The single-color design is in use in some 12 states according to Mr. Waters' survey, of which three use yellow altogether.

Arguments for AASHO Standard

In favor of the existing AASHO standard it is argued that:

1. The use of a yellow barrier line makes no-passing zones conspicuous and distinctive by day and by night.

2. The solid center line should be optional because (a) where a black center line is used on a center joint of a concrete pavement it is practically necessary to make it a solid line. Hence the significance of a solid line as a line that must not be crossed cannot be maintained, and (b) there is no need for a special type of center or lane line to show where passing is permitted, if no-passing zones are marked with a special double line to show where passing is not permitted

3. The two-color system is not incompatible with the use of the broken center-line. If the arguments for the

broken center line are valid they apply with equal force to a broken line under the two-color system. The Joint Committee at its July meeting voted to make the broken line the *preferred* design for center and lane lines.

4. A very considerable number of states prefer a solid center line, because (a) there is no evidence that a broken line is as effective as a solid line in dividing opposing lanes of travel, and (b) it is not practicable to repaint broken lines accurately on top of previously painted broken lines, hence broken lines become very ragged after a few repaintings.

5. The AASHO design is easily applied with three paint guns, one for the white center line and one on either side for the yellow barrier lines.

6. The cost of laying down two colors is not significantly greater than that of laying down a single color.

7. The AASHO two-color system with yellow barrier lines is in use (with broken or solid center line) in at least 17 states, according to Mr. Waters' survey, with at least five additional states using a yellow center line with white barrier lines. Thus a two-color system is found in a majority of the 36 states that use any sort of barrier lines for a "directional" indication of no-passing zones.

What State Leaders Think

To discuss a few of the variations, California's new pattern is similar to that used in a number of eastern states. Their change, which resulted in a large-scale re-paint program, calls for a 4-in. broken centerline having 9 ft. of stripe alternating with 15-ft. skips. (wartime stripe was 4 in., with 15-ft. stripe and 25-ft. space.) The shorter distances were adopted to permit more satisfactory use of a broken line in foggy or mountainous areas. A solid white line is used for the barrier on No-Passing zones, and the pattern becomes two solid lines when passing is not allowed from either side. To illustrate the lack of uniformity, Oregon engineers believe in a yellow solid centerline, as being cheaper and of maximum visibility under widely varying conditions. Idaho, along with numerous states, now uses a yellow dash centerline. Adopted for wartime economy, it is being retained on all except certain long mountain grades or sections of continuous curvature. "As we catch up with our work," explains materials engineer C. C. Hallvik, "we will add a 4-in. white barrier, first where vertical sight distance is restricted, then on horizontal curves."

Colorado just reverses this color

scheme, using a white or black centerline and a yellow barrier, in conjunction with the sign "Do not cross yellow line when it is in your lane." Mississippi has this scheme, too, which is in accord with AASHO 1940 standards.

Missouri's Special Scheme

Missouri also has a yellow no-passing barrier stripe, but places it in the center of the traffic lane rather than immediately adjacent to the center stripe. In comment, Rex Whitten, state maintenance engineer, states that this keeps the stripe out of the path of tires and results in greater life of the paint. Traffic seems to react well to this arrangement, he reports, further adding that Missouri is prepared eventually to go to some other standard if necessary for national uniformity.

How to carry striping patterns through cities, without always having sufficient cooperation from local authorities or legal jurisdiction over the matter, is one of the serious points in the over-all problem. C. C. Hallvik of Idaho says, "The Idaho state department of public works proposes to ask cities that stripe their streets to use white traffic paint for lane markings except on through designated highway routes, where yellow conforming to our highway stripe will be used. In this way we feel that route markings and directional markers will be supplemented by another means for the motorist to follow his route. The tourist then knows he is on the main highway."

Many Engineers Have Vigorous Ideas

The most serious dissent from proposed national standards has come from certain eastern states. Alex. Muir of New Jersey comments on the possibility that the committee's find-

ings may be at variance with the definite trend of procedure in the Eastern states, dispute being over the compulsory use of a two-color line combination, a finding which he believes unfortunate. New Jersey needs legislative action to improve its No Parking zone markings, he notes.

Even in the matter of solid vs. broken centerline there is sincere difference of practice and opinion. B. W. Davis, of North Carolina, for instance, states that he personally prefers a solid 4-in. line for lane markings, with an added 4-in. yellow stripe on the right for No Passing. Pennsylvania, according to Warren K. Myers, has recently adopted use of a broken line paralleled by a solid line on vertical and horizontal curves. Texas uses a black cut-back asphalt stripe, lightened at times by selection of stone in the chip cover, with a dash line barrier of similar composition.

Vermont has decided to put off use of a secondary or barrier line entirely for the present, due to the wide prevalence of 18-ft. pavement in hilly winding sections, which results presumably in a more continuous alertness on the part of the motorist and which would make a barrier program prohibitively costly.

C. R. Waters of N. Y.

C. R. Waters of New York State feels as follows on this subject:

"We use the dash system for marking center lines on 2 lane and for lane lines on 3 and 4-lane pavements. We mark No-Passing areas with a solid line parallel to the dash line. A solid line in the driver's lane indicates to the driver that he should not cross the center line in that area. After he has passed the crest of a hill the driver may cross the line if the way ahead is clear, where the dash line is in his lane. This is really a very simple system. It is described in the AASHO

W. W. Polk, Chief Highway Engineer, Illinois: "It appears to me that 1946 and possibly part of 1947, constitutes a transition period in two phases. One is the changes in design and application brought about by the new standards adopted by the national committee. The other lies in the reconversion from wartime to peacetime conditions. The latter phase is perhaps the more important since the material situation affects most of us whether or not any change in our standards are necessary."

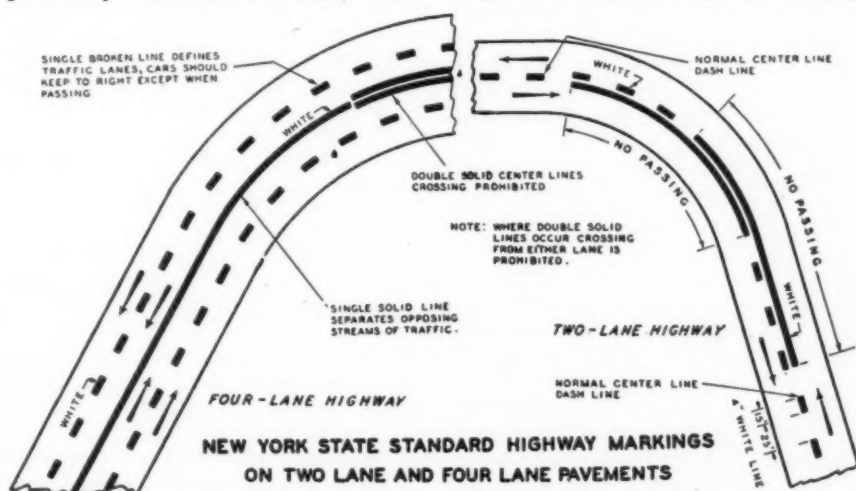
Policy, and if it were universally adopted there is no doubt that it would be an important contribution toward the prevention of accidents.

"It should be noted that 90% to 95% of the improved highways in the State Systems, according to PRA records, are 2-lane pavements; hence, it seems to me that if a standard could be developed for 2-lane pavements, the question of arriving at standards for 3 and 4 lanes would adjust itself. It would simply be a modification of the 2-lane method.

"The great trouble with arriving at a standard is that the present Policy states that the center line of 2-lane pavements should be either a solid line or a dash line. That difference allows for various combinations of lines in 'No Passing' areas. Some states use two solid lines; some use a dash line on the left and a solid line on the right; some reverse this; some use a dash line for the center line paralleled by a solid line, and the statistics I have gathered show that 12 to 15 various types of markings exist, including variations in color. On the Atlantic seaboard alone there have been 6 or 8 different types in use.

"The colors of the lines are, of course, mixed up in the subject, but to my way of looking at it this is not so important. If the symbols on the pavements could be made uniform, the colors of the lines could run their own course.

"There is good reason for the use of dash lines to separate the lanes on 2-lane pavements," continues Mr. Waters. "Fundamentally, a dash line represents a place where crossing is permitted; a solid line represents a place where crossing is either prohibited or allowed on a cautionary basis. If travelers are not permitted to overtake and pass other cars going in the same direction the efficiency of a 2-lane road to handle traffic is



★ Will this be the national standard? Or will there be a nationally uniform system of pavement marking?

restricted, and if drivers cross a solid line to pass and overtake other vehicles they are not following the proper procedure. Of course the driver, in that case, is not at fault; the trouble is using the solid line for the wrong fundamental purpose.

Dash Saves Paint

"Several States have apparently decided to use the dash center line, instead of the solid. This indicates a gain for this method and shows the trend. From an economical standpoint there is a great saving in paint. In New York we use 15 gal. of paint per mile to paint a solid line 4 in. wide; only about one-third of this amount for a dash line 15 ft. on and 25 ft. off. In painting 10,000 miles of pavement this represents a saving in the purchase, handling and application of 100,000 gal. of paint."

The standards of this state have not been changed since 1940. In the words of N. Y. Superintendent of Public Works Charles H. Sells—"They are effective, enforceable, easily understood, with unanimously favorable reception by the public."

Waters Defends Broken Line

Mr. Waters of New York states also:

"Under the heading Arguments For in the PRA memo it is stated that there is no evidence that a broken line is as effective as a solid line in defining opposing lanes of traffic. We are not in agreement with that statement for the reason that eight years of experience in New York State prove to us that a broken line is as satisfactory as a solid line for this purpose, and in some ways it is better. Massachusetts, Virginia and many other states support the evidence to prove that a broken line is fully as effective as a solid line. We even believe the statement that there is no evidence on this point, is entirely unwarranted.

It seems to me that it ought not to be a particularly difficult job to achieve uniformity throughout the United States. It should be mentioned in passing that the Provinces of Ontario and Quebec, stretching across our northern boundary, use the same system as New York State, and there is good prospect of attaining an international as well as a national system."

Mr. Waters also offers: "I feel that the question of the color of center or barrier lines is secondary, and if uniformity could be attained on the types of lines the question of colors could be determined in succeeding years. There is no doubt, in my opinion, that white has greater visibility

than yellow, when consideration is given to night-time travel. Letters which I have received from Louisiana and Minnesota confirm this."

Minnesota's Experience

Another point is made by C. L. Motl, maintenance engineer, Minnesota:

"To begin with, emphasis in Minnesota was placed on color schemes; that is, the use of white paint for one indication, yellow for another, and black paint on white surfaces such as concrete. Observations over a number of years lead one to believe that color schemes are not effective insofar as the average motorist is concerned. In Minnesota we have been suggesting the use of construction differentiation rather than color differentiation as a means of indicating to the road user what is wanted and desired.

"On a recent trip which covered ten of the northwestern states, west of Minnesota, I was quite observant of the various schemes used in the various states. Some used a solid centerline, either white or yellow, and a 'No Passing' line of the contrasting color, also either white or yellow. Others used a broken centerline with a change to solid line over hazardous parts of the road, and so on.

"One of the first things I noticed was that during early morning or late evening hours, when there was a reflection of light from the road surface, it was impossible to tell any difference in colors; everything looked black. Where both centerline and 'No Passing' zone line was continuous there was often a question as to what was intended because one could not always remember which color was supposed to be the 'No Passing' line. In those states where a broken centerline was used and a solid 'No Passing' zone line was used there was never any question as to what was intended, regardless of the color scheme. I am, therefore, of the firm belief that the color control plan should be dropped and states should use any color they wish, but standardization should revolve around using a broken centerline and a solid 'No Passing' line.

"A point in favor of using the broken centerline seems to be the convenience this type of line affords in handling traffic. It is possible for traffic following the marking operations to cross over the centerline without smearing the paint. Most travelers naturally avoid getting paint on their tires, thinking that the paint in turn will get on their cars; therefore, they drive through the gaps.

Where solid centerline is used it is very noticeable that the paint is smeared over the pavement at frequent intervals.

"In Minnesota we are using AASHO recommended standards of a broken centerline and solid 'No Passing' lines, the centerline being either white or black and the 'No Passing' line being solid yellow. We have had some criticism of our broken line design in that we use a 10-ft. painted section and a 40-ft. gap. We are going to lengthen the painted section and likewise the gap. In some of the western states I noticed that they use a 35-ft. painted section and a 65-ft. gap with very good results. Incidentally, by using a dash-plus-gap interval of either 50 or 100 ft. there is automatically provided on the traveled roadway a constant measuring scale for erecting signs, estimating maintenance work, distance, etc."

[Experiences of the state highway departments in obtaining paint, the growing use of reflector beads in the stripes, and some of the methods and equipment now in use for putting down stripe, will be reviewed in an early issue of "Roads and Streets."]

Meetings Ahead

Highway Research Board—26th Annual Meeting, at National Academy of Sciences and the National Research Council, Washington, D. C., Dec. 5-8.

Society of Experimental Stress Analysis—Hotel New Yorker, New York, N. Y., Dec. 9-11.

Southern Michigan Road Commissioners Assn.—Pantlind Hotel, Grand Rapids, Mich., Dec. 11-12.

Associated Pennsylvania Constructors—annual convention, Bellevue-Stratford Hotel, Philadelphia, Dec. 11-12.

American Association of State Highway Officials—annual meeting, Biltmore Hotel, Los Angeles, Dec. 17-20.

Associated General Contractors of America, Inc.—annual convention, Stevens Hotel, Chicago, Jan. 27-30.

Associated Equipment Distributors—annual meeting, Edgewater Beach Hotel, Chicago, Feb. 13-16.

American Road Builders Assn.—44th annual convention, Palmer House, Chicago, Feb. 17-20.

Association of Highway Officials of North Atlantic States—annual meeting, Hotel Traymore, Atlantic City, N. J., Feb. 26-28.



Picture of the Month

This picture isn't a happy one—for anybody except the union bosses. Whereas in previous months we've reserved our monthly Picture for some outstanding projects, or engineering development, we dedicate it this month to spotlighting the alarming growth of feather-bedding and other efficiency blighting policies of certain of our labor unions.

What are the guys doing here in this picture for \$1.50 per hour per each? Obviously, nothing! Their work is to crank their sump pumps in the morning and turn them off at day's end, and see that each is supplied with gasoline and oil. A dozen or so shallow cofferdams were being de-watered on this bridge approach project. There was a pump for each pit. One man could easily have operated them all, and an old fashioned red-blooded American workman would have considered it an insult to his manhood if you thought any different.

But no, there has to be a man to every one or two pumps here, because the union says that no one man can care for pumps more than 100 ft. apart. And at a time when two jobs are begging for every construction worker willing to work. And there must be a mechanic to change spark plugs, stop air

leaks, drain the crank case, place the pumps. That means higher bid costs, higher costs for the roads and bridges the public needs. It is a vicious form of inflation, and a twin brother of jurisdictional edicts which decree, for example, that only a structural iron worker can pick up a reinforcing bar, or that cement grouted joints in a culvert pipe must be made by a cement finisher while caulked joints are a steamfitter's or plumber's prerogative.

It would be all so juvenile if it wasn't such a serious matter of concern to the construction industry and the public who finally pays the bills. What constructive suggestion do we have to offer? Alas, none that can precede a revamping of national legislation, and that must come through a ground swell of public sentiment. Road builders and contractors ought to present facts more often to their congressmen. Of course there are some enlightened union officials. And meanwhile also credit goes to many contractors who, individually and through their associations, have sought with some good results to establish the best possible understanding with their local unions.

Skousen Construction Co. on US 85, New Mexico

Contractors at Work



★ N. J. Skousen with George J. Johnston, asst. state constr. engineer



★ E. R. Hise, Skousen's superintendent. Not snapped was Baker Flower, project engineer

★ One of the 75 culverts on the 11.5 miles which had to be extended on both sides to meet new cross-section requirements. This is a "double-double box" of unusual design. The structure considered normal for anticipated flow was duplicated beyond the dividing wingwall, as an extra factor of safety against clogging of the flat stream-bed by sage brush. A 15,000 cache of plywood came in handy for Skousen

THIS project is noteworthy for the fine modern equipment (that is, mostly) mustered by the contractor. Also, as an example of the high standard of grade, line, cross-section, and surface being employed by many western states for interstate route modernization where traffic and economic importance justify. These scenes were taken on one of two adjoining contracts comprising 11.5 miles eastward from Santa Fe. Fred G. Healy, state highway engineer.



★ Earth was thoroughly compacted around culvert extensions. As the dozer pushed up scraper dirt, a crew worked three to five heavy-duty pneumatic tampers supplied from a 105-cts. truck-mounted compressor



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★ A nice looking multiple box culvert extension. Note concrete apron (inlet side). Also note absence of a hand-rail, considered unnecessary at this distance down the slope. Slow steel deliveries complicated the culvert job. As high as 21 sets of forms were in place at one time waiting for steel



★ Skousen's 63 and 73 cent bids on unclassified included considerable rock, which was handled with truck-mounted compressors supplying both jackhammers and wagon drills



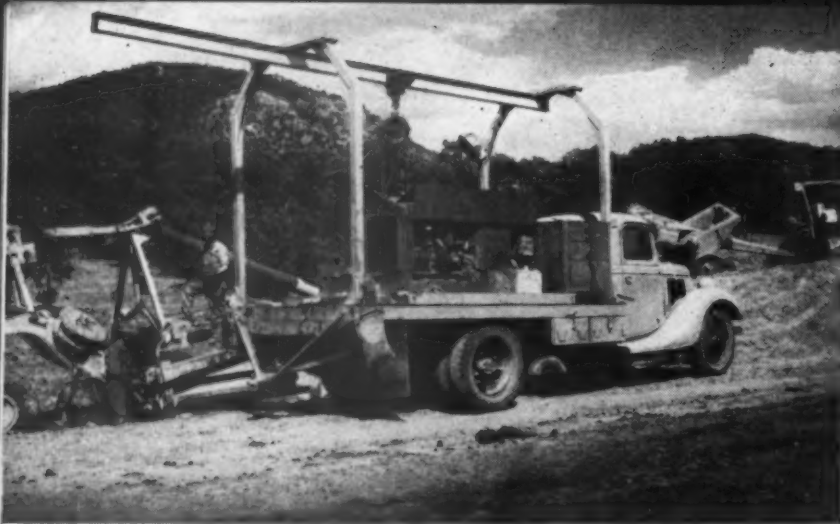
★ 5/8-yd. truck-mounted excavators played an important part in Skousen's operation, filling in spare time by stockpiling

★ "Pull them nails carefully, brother, lumber is scarce!" Forms were rebuilt and reset, using available boards many times. Green lumber made some trouble. In spite of shortages the crew poured over 1,000 cu. yd. of culvert concrete per month, aided by dry batching to a 3-bag mixer with 6-batch dump trucks instead of piling aggregates at each box (new in New Mexico). Result: a culvert crew of 8, instead of twice that number



★ This mobile crushing and screening plant produced both washed culvert aggregate and 1-in. road mix material. The normal 75-ton-per-hour capacity was "souped" up to 175 tons for handling leveling course sand by installing wider belts and gearing up throughout





★ Handy outfit is this truck fitted with a hoist rail for handling replacement motors, pumps, other small units. Shown here delivering a 300-amp. gasoline powered electric welder to scene of a break-down

★ Another handy trouble-shooter rig—a hoist which revolves around a vertical post

★ Another mobile clamshell—at the dry-batching plant which served 5,000 cu. yd. of culvert concrete



★ Finishing and rolling the leveling course. Water is being bladed in for final shaping and rolling prior to preparing for replacement of prime coat. The complete process of topping out the grade was as follows: After completion of the compacted embankment, two 4-in. courses of ballast are placed (3-in.-max crushed stone). Then 3 in. of 1-in. max leveling material, as shown. Base thus is 11 in. combined thickness



★ Priming the leveling course with 25 gal. application. Next was placed the top course surfacing, which was later road-mixed with MC-3 oil (about 5%). This course was compacted to 2 in. thickness and a .3 gal. seal of 200-300 pen- asphalt added, followed by 3/8-in. crushed rock cover. (Right) How asphalt delivery tank was chained down



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33,200
700

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7,697
775
1,375
20

270
137
4
196
508

ROAD



★ "AFTER": Heavy traffic on the Las Vegas—Santa Fe—Albuquerque axis justified this modernization, which follows interstate standards and insures high-speed travel with utmost safety and operating economy for motorists and truckers. Largest cut, 55,000 cu. yd.

★ "BEFORE": Compare the short sight distance and narrow width of the old grade on U. S. 85 with the modern roadway pictured below



Bid Prices on U. S. 85 New Mexico Project Pictured on the Preceding Pages

Figures for 7.697 miles of grading, new or lengthened culverts, base and surfacing, U. S. 85 Santa Fe to Canoncito, New Mexico. Awarded Jan. 26, 1946, to Skousen Construction Co. Bidders and totals were:

(1) Skousen Construction Co., Albuquerque..\$543,284.94

- (2) Loudermilk Bros., Denver 546,372.96
(3) Harry Thygesen & Co., Albuquerque.... 573,506.12
(4) Armstrong & Armstrong, Roswell, N. M. 600,080.69
(5) Alleson & Haney, Albuquerque..... 615,361.17
(6) Brown Bros., Albuquerque..... 644,122.60

Bid Item	(1)	(2)	(3)	(4)	(5)	(6)
Lump sum removal of old drain structures.....	15,000.00	14,000.00	14,400.00	16,500.00	18,000.00	7,000.00
Lump sum removal of obstructions	500.00	500.00	400.00	600.00	5,000.00	100.00
225,000 Cu. yd. excavation—unclassified	0.73	0.67	0.86	0.87	0.85	0.90
4,010 Cu. yd. excavation for structures.....	2.00	2.50	1.50	1.75	2.00	1.50
500 Cu. yd. excavation pipe culverts.....	2.00	1.50	1.50	2.30	2.00	2.00
653,200 Sta. yd. overhaul	0.02	0.01	0.02	0.03	0.03	0.02
50,600 Hr. yd. haul	0.12	0.075	0.08	0.06	0.07	0.08
1,290 Hr. rolling sheepsfoot	4.00	5.00	5.00	4.50	6.00	4.00
815 Hr. rolling—steel tired	5.00	5.00	5.00	4.50	6.00	5.00
77 Hr. rolling—pneumatic tired	4.00	10.00	4.50	5.00	8.00	5.00
3,390 M. gal. watering.....	1.50	2.25	2.00	2.30	3.00	4.00
3,679 Cu. yd. Class "A" concrete.....	28.00	32.00	30.00	30.00	30.00	34.00
394,200 Lb. reinforcing steel.....	0.063	0.0725	0.065	0.07	0.08	0.08
1 Each gate and cattle guard—14' roadway.....	700.00	900.00	500.00	500.00	900.00	300.00
4 Each gates—Texas type.....	10.00	10.00	5.00	10.00	5.00	5.00
347 Each bracing	2.50	5.00	3.50	3.20	2.00	2.00
100 Each right of way and station markers.....	5.00	5.00	5.00	4.00	5.00	4.00
83,400 Lin. ft. removing and rebuilding fence.....	0.06	0.10	0.09	0.11	0.10	0.06
3,200 Each new posts, rebuilding fence.....	0.75	1.00	0.50	1.00	0.60	1.00
4,600 Lin. ft. contour ditches.....	0.10	0.10	0.10	0.09	0.10	0.10
995 Hr. mechanical tamping.....	5.00	4.50	5.00	3.50	5.00	3.00
71,470 Ton ballast	0.55	0.65	0.58	0.66	0.60	0.82
33,200 Ton leveling course	1.00	0.75	0.70	0.86	0.90	1.30
700 Bbl. cutback asphalt—Type MC-1	4.70	4.50	5.00	4.50	4.80	5.00
3,615 Bbl. cutback asphalt—Type MC-3	4.50	4.25	4.50	4.50	5.00	5.00
11,450 Ton top course surfacing.....	1.00	1.00	0.80	0.82	1.00	1.00
7,697 Mile mixing asphalt and aggregate.....	900.00	900.00	800.00	800.00	750.00	800.00
775 Bbl. 200-300 asphalt (seal coat).....	5.00	4.50	5.00	4.80	5.00	5.00
1,375 Ton aggregate—seal coat	5.00	4.50	4.50	4.00	5.00	5.00
20 Cu. yd. rock and wire check dams.....	20.00	20.00	7.00	12.00	9.00	10.00
270 Each warning posts	5.00	6.50	8.00	7.00	6.00	8.00
137 Each reflectorized warning posts	5.00	7.00	8.00	7.50	6.50	8.00
4 Each removing and rebuilding cattle guards.....	150.00	200.00	250.00	300.00	600.00	300.00
196 Lin. ft. corr. met. culv. pipe—24".....	4.00	3.50	5.00	3.20	3.00	3.00
508 Lin. ft. corr. met. culv. pipe—36".....	7.00	5.80	7.00	6.00	4.00	4.00

Highway Research Board Panel Discussion on Concrete Paving Joints

Notes on the much-talked-of "Saturday night" session at the Board's annual meeting at Oklahoma City last January

EXPANSION joints in concrete pavement—are they necessary, and if so what spacing?

Can they ever be entirely eliminated?

What factors in pavement design, construction, and traffic use should be given greater attention to reduce joint failures?

These are a few of the many questions aired at a four-hour panel discussion of concrete paving joints which represented a high point in the Highway Research Board's annual meeting at Oklahoma City last January.

The occasion of this meeting in itself constituted an acknowledgment that joints, particularly expansion joints, represent a major design problem far from being completely solved. That longitudinal joints and contraction joints are with us to stay was an agreed trend of thought. The main controversy centered around expansion joints and the related questions of load transfer and distributed reinforcement. While practice among

the states will doubtless continue to vary, the announced trend in several states is away from expansion joints, it would seem from this discussion. Few delegates stood up to defend the traditional joint spacing, while several voiced very definite opinions that expansion joints should be used much less frequently if not eliminated entirely in their states.

Panel leaders, under chairman C. N. Conner (PRA) and discussion leader R. D. Bradbury (PRA), included R. H. Baldock (Ore.), representing economics, finance and administration; L. W. Teller (PRA), design; C. H. Scholer (Kansas State College), materials and construction; Rex M. Whitton (Mo.), maintenance; E. H. Holmes (PRA) traffic and operation; and Harold Allen (PRA), soils. Harold Allen, Principal materials engineer, Public Roads Administration, Washington, also presented a report of the Board's committee on joints in concrete pavements.

Serving to pace the entire session, R. H. Baldock counseled delegates to

avoid dogmatic assertions and unfounded opinion and approach this controversial subject logically. The basic objective in any phase of highway engineering is economical, safe and adequate transportation; the yardstick of measurement, annual highway cost or total cost through the years including driving as well as costs appearing on the highway department books. The driver cost penalty due to inherent defects in design, he warned, may exceed that of annual maintenance costs.

In Oregon, said Mr. Baldock, a close relationship is maintained between empirical design formulas and experience. His stated conclusion for Oregon was that expansion joints are not needed and that their inclusion weakens a pavement. Expansion joints have been eliminated, construction joints at the end of each day's run are put on concrete sills, and contraction joints (without dowels) are spaced 15 ft. When expansion joints are omitted it is observed that the pavement stays in compression, hence mechanical interlock of contraction joints is maintained and dowels become unnecessary.

Economics of Joints Inconclusively Discussed

H. S. Fairbank, deputy commissioner of PRA, interjected a challenge, saying that we can compute the first cost of putting in expansion joints, but did anyone know what it costs to leave them out? This question went unanswered in specific terms, revealing a serious lack of cost data which in the minds of some delegates served to throw doubt over much of the ensuing discussion.

E. F. Kelley, chief, division of physical research, PRA, answered Mr. Fairbank in general terms, stating that under average conditions the maintenance and over-all costs of concrete pavements are less without

Editor's Note: The meeting reviewed herewith represents a long-overdue airing of a highly controversial subject. We can think of no phase of highway engineering on which there has been more diverse opinion than that of concrete pavement joints.

Unfortunately no stenographic transcript was made of the session. This review represents your editor's best effort to record some of the more pertinent statements "long hand." Writer's cramps being what they are, the notes make no pretense of being complete, but we did try to convey exact meanings intended and in many instances have expressed the actual phraseology used by the speakers.

At first our feeling was to table these notes because of their incompleteness. We realize that any such discussion—and especially an informal review—is open to challenge from those who may differ with the way the debate went. Engineers who are for "status quo" on present joint practice certainly were conspicuous by their silence or absence.

Perhaps at the forthcoming December meeting of the Highway Research Board these engineers will speak up. There certainly are many engineers who favor continued traditional use of expansion joints in concrete pavement. Otherwise why do standards of so many states continue to call for them?



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expansion joints than with them, the chief difficulty being blow-ups when joints are absent. However, he introduced the factor of steel reinforcement. He stated that he is not sure longitudinal joints are needed if reinforcing steel is used to hold longitudinal cracks to such a fine width that they'll need no maintenance. Steel reinforcement is distinctly beneficial in transverse joint design, he felt, in that it permits leaving out some of the joints. He suggested further investigation of the possibility of designing concrete pavements with suitable reinforcement and without any joints at all. If such designs prove satisfactory it is possible that their extra cost may not exceed the cost of joints and their maintenance.

Mr. Baldock also outlined purported advantages of joint omission in general terms: saving in installation and maintenance cost and elimination of source of roughness.

Frank T. Sheets, president, Portland Cement Association, and former chief highway engineer of Illinois, listed the many factors which must be considered in the rational design of a strip of pavement, including joints. These include laying temperature, weather range, moisture change in the slab, coefficient of expansion of the concrete. Relative short paneling with dummy joints is needed to control intermediate cracking (15 to 20 ft.), he agreed, while expansion is required at intervals of not less than 400 ft. for most severe cases and 600 to 800 ft. under some conditions, with no expansion joints at all needed in many cases.

The purpose of joints, observed Mr. Sheets, should be to provide expansion joints to avoid critical stresses in compression and contraction joints to control cracking. Load transfer devices are needed at times, but it is difficult to install them correctly. Mr. Sheets' plea was to design a joint system based on consideration of all service factors.

Blow-ups—How Serious?

The subject of blow-ups inevitably came in for discussion. Oregon's experience—concurrent in by Missouri and others—is that blow-ups occur most frequently on curves and summits, and that due to faulty maintenance it is possible to have more blow-ups with expansion joints than without them.

Viewpoint of Materials and Construction

Prof. Scholer introduced the neglected viewpoint of the construction man. All joints, he observed, make work for the contractor since load

transfer devices and fillers must be assembled and set; and there is often trouble in keeping the assemblies in exact position and working concrete into the pockets. Special mixes or aggregates are sometimes warranted around joints, he stated.

Aggregates are even more of a factor than climate in joint design, said Prof. Scholer. There may be a 100 per cent difference in expansion modulus of elasticity of concrete made with different aggregates. This factor is a neglected one in determining joint spacing. The designer doesn't know ahead of time what materials will be used or have enough data on the aggregate's characteristic. On the other hand, varying specifications from job to job will bewilder the contractor and affect bid prices.

Traffic Survey Data Needs Application

Mr. Holmes, speaking from the traffic standpoint, reminded that, to the motorist a joint is a bump. The magnitude and frequency of load passages over a joint are important considerations not properly weighed in joint design. A great volume of valuable data gathered through planning surveys have not yet been put out in a form that will help design joint systems. Chief cause of pumping, he noted, is a high frequency of heavy axle loads.

Many questions on traffic were asked but not answered, such as: What is the effect on joints when long columns of heavy (military) vehicles pass, subjecting the relatively slow pumping cycle to fast repetitive loads? What relative effect on joints do vehicles have at various speeds? What is the critical axle load, beyond which a given joint under a given traffic pattern will begin to show distress rapidly? What effect of distribution of wheel paths over the pavement width? Effect of shoulder width?

Traffic engineers heretofore have worked closely with designers on geometric phases of highway design. Mr. Holmes said that the traffic division of PRA would welcome a clear statement as to the type of traffic information pavement designers need to help improve jointing and other details of the pavement itself. The combination of load and temperature differential is the "nubbin" of the joint problem, added Chairman Bradbury. Day and night distribution of traffic also is a factor.

Importance of Subgrade Treatment

Several spokesmen stressed the importance of subgrade treatment in con-

crete pavement design. One speaker urged that relatively more attention be given to subgrade design and less to analysis of the slab. Dr. Gerald Pickett, Kansas State College, warned that we must design for stresses in the subgrade as well as the pavement, and not just perfunctorily find a subgrade modulus. In the slab itself, deflection from warping or tilting, rather than stress distribution, causes the most trouble. Whereas edge stresses are 35 per cent higher than interior stresses, edge deflection of a slab is $3\frac{1}{2}$ times the interior deflection, and corner deflection 8 times as great.

The value of a good foundation in concrete pavement performance generally was touched on by J. E. Lawrence of Massachusetts, who said his state has had no joint pumping because of good base construction. Mr. Baldock of Oregon also stated that his state has eliminated pumping and materially stabilized pavements by use of a gravel blanket in the past ten years. Seventy per cent sand content is required, in layer of 3 to 6 in.

Oregon has tried all types of underseal mixtures to correct pumping in older pavements. Lately the preference is for 30-40 pen. hot asphaltic cement.

Wilson T. Ballard of Maryland also felt that designers must give more attention to subgrade treatment, especially with the view of reducing corner stresses. A strengthening factor in the subgrade at joints such as a sill warrants consideration. Designs should be based on dynamic rather than static loads.

But blindly treating all subgrades is also wasteful, counseled Mr. Sheets, who again urged rational analysis of each problem. That we now have the means of identifying pumping soils was noted by A. A. Anderson, Portland Cement Association. Regarding traffic he said we need more information to help predict the incidence of heavy axle loads from 10,000 lb. to the maximum.

Missouri Experience

F. C. Reagel, material engineer, Missouri, also spoke conviction that fewer joints are desirable. Surveys conducted on hundreds of miles of Missouri pavements, he said, show among other things that the number of cracks is increased by the substitution of expansion joints for contraction joints. Various designs have been tried, first using no joints, then contraction joints only, some expansion joints along with contraction joints, and expansion joints only.

There is a radical difference in joint performance between various

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aggregates, he reminded. When low-expansion aggregates are used, blowups can be prevented entirely with contraction joints. Concurring with Mr. Baldock, he said that blowups are always due to eccentric flexure rather than straight compression.

A walking check of existing pavements was recommended by Mr. Reagel as a vital step to take before forming conclusions. "A walking survey will give you a lot of answers," he said. "Every state has a great mileage of roads that can tell a story if we read it."

Riding quality as affected by joints was the chief concern voiced by O. L. Kipp, of Minnesota, where many miles of concrete pavements have relatively light traffic. Best designs reported for this state embody contraction joints at 15 ft., with no expansion joints or distributed reinforcement.

Whether frequent (15 to 20 ft.) spacing of contraction joints adds to surface leakage of a pavement and more frequent pumping, was a question raised by J. E. Williamson of South Carolina. No conclusive answer was given.

Tilting of slabs under extreme loads as encountered under heavy airfield traffic must be reckoned with, said a representative of the U. S. Engineers. This phenomenon, with resultant depression and pumping, is a problem on airfields and involves contraction as well as expansion joint spacing.

The U. S. Engineer experience is too young to afford the factual data to warrant modification of present design methods, observed Gail McFadden of that organization, who touched on the research in progress at Lockburne Air Base.

Purdue Studies

Purdue University's extensive research was reviewed by K. B. Wood, who summarized an analysis of joint performance in Indiana. That state has 2,500 miles of older concrete pavement without joints, and he estimates that it would have cost \$850,000 to have included joints in these roads as required under later specifications. The \$20,000 or so required to repair a couple of hundred blowups, possibly caused by omitting joints in these roads, is small by comparison.

Five-Year Highway Program for China—Construction of 118,430 miles of new highways is the goal of the Chinese national government's new 5-year roadbuilding program. Main roads will be under the control of the central government; secondary roads will be administered by the provinces.

Calloway of Goodyear Heads ARBA Nominations for 1947

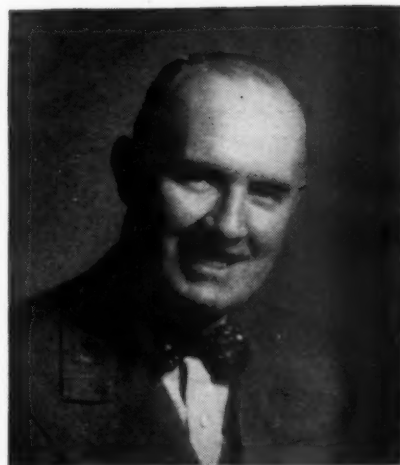
The following names have been submitted by the Nominating Committee of the American Road Builders Association to head up the organization in the coming year:

President: J. T. Calloway, Asst. to Vice-Pres., Goodyear Tire & Rubber Co., Chicago.

Vice-Presidents: Paul B. Reinhold, Pres., Atlas Equipment Co., Pittsburgh, Penn.; Charles W. Smith, Pres., Smith Engineering & Construction Co., Pensacola, Fla.; W. A. Roberts, Vice-Pres., Allis-Chalmers Mfg. Co., Milwaukee, Wis.; Robert A. Allen, State Highway Engineer, Carson City, Nev.

Treasurer: H. C. Whitehurst, Director of Highways, District of Columbia, Washington, D. C.

Directors: (term ending 1950): James C. Alban, Pres., Alban Tractor Co., Baltimore, Md.; Perry T. Ford, Director of Highways, Columbus, Ohio; Frederick Hoitt, Secretary, New England Road Builders' Association, Boston, Mass.; E. R. Needles,



J. T. Calloway

Howard-Needles-Tammen & Bergendoff, Consulting Engineers, New York, N. Y.; C. W. Phillips, Commissioner of Highways and Public Works, Nashville, Tenn.; Walter Toebe, Exec. Secy., Michigan Road Builders' Association, Lansing, Mich.; Charles M. Upham, Engineer-Director, American Road Builders' Association, Washington, D. C.

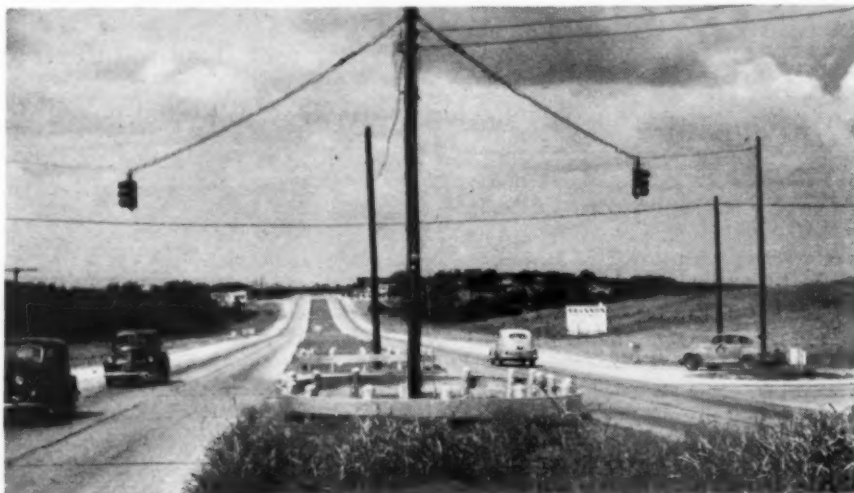
Two Lights Improve Traffic Control at Divided Highway Intersection

Occasionally an attempt is made to handle traffic at a junction of two 4-lane highways with a single overhead stop light. This was the case at the intersection of state routes 183 and 199 on the edge of Fort Worth, Texas, one of the roadways in this instance being a divided roadway with a grassed median strip.

A number of intersection accidents had occurred here, and analysis showed that the trouble might be due partly to the fact that the single overhead light was not directly over either of the divided pavements. Not only was it off-side, being over the center of

the median strip, but also a test run revealed that the light was partially hidden from the oncoming motorist by one or the other of the support poles, which were also centered on the median strip.

Last April the maintenance engineers were able to dig up an extra light (still scarce and hard to come by). One of the support poles was relieved of duty by erecting two poles in its place, one on each outer shoulder of the divided highway, and the two lights were re-strung as shown in the photo. At last report no serious mishap has since occurred at this intersection, according to district maintenance engineer E. J. Willson and district engineer C. M. Garrett of the state highway department.



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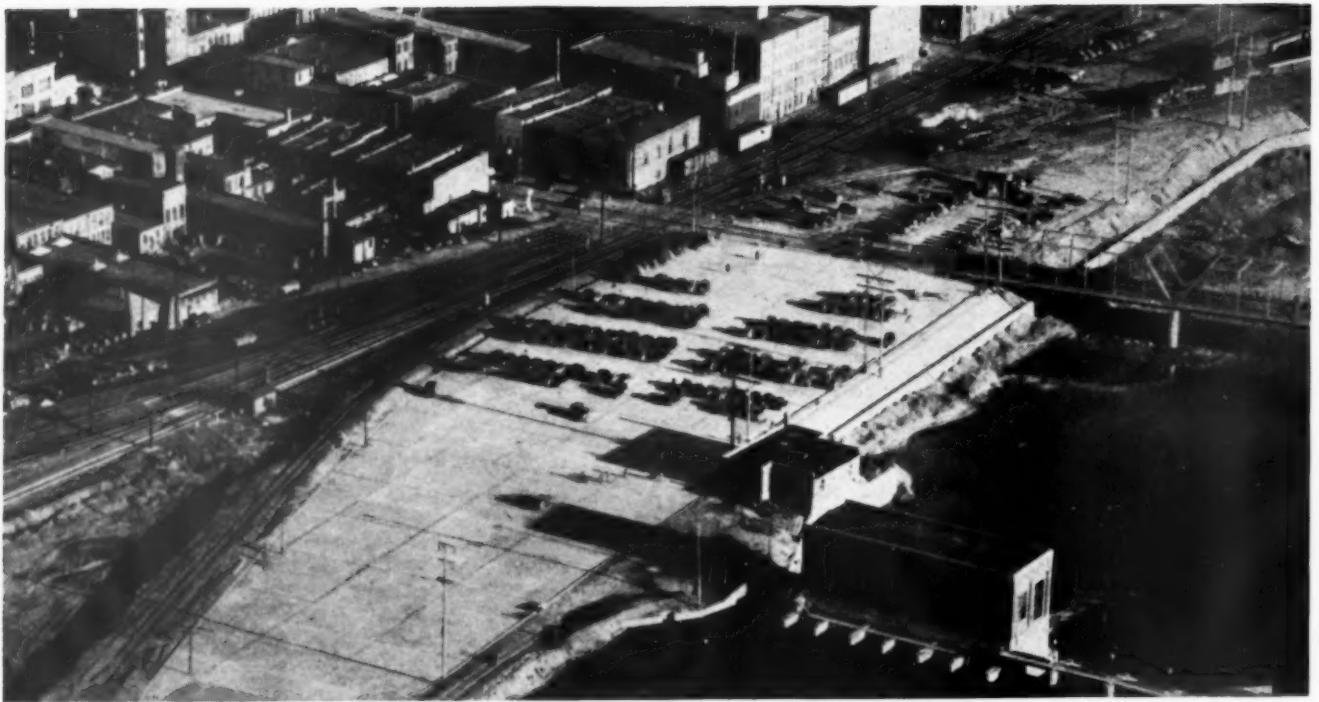
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★ In Ottumwa, Iowa, an unsightly riverfront was converted into a parking lot where 1,000 cars can be parked at one time

Action on parking problem

What some cities are doing to meet the acute and still growing need for downtown parking facilities

By Paul Donald

Public Roads Administration,
Washington, D. C.

LOS ANGELES has a three-way program that is expected to create 10,000 additional parking spaces in downtown sections of the city within three years. At present the city has some 40,000 parking spaces. City officials, civic leaders and merchants agree, however, that additional parking facilities must be provided to keep customers coming downtown.

One plan under consideration is the construction of a four-story garage beneath Pershing Square, near the center of the downtown business district. It would contain 2,500 parking spaces, and cost some \$3,000,000. The garage would be financed and operated by private enterprise but would

revert to the city when paid for by earnings.

As another step in the program, private operators will be permitted to lease and operate several new outdoor parking lots, with a total capacity of 3,000 cars, on sites adjacent to the business district. Two thousand spaces would be reserved for short-time parking by shoppers. These lots are expected to be in operation by the end of the year.

The third phase calls for establishment of a Metropolitan Parking District which would operate under the benefit district plan. The district would provide, by lease or purchase, some 4,500 car spaces in open lots and garages. Retail stores and property owners who stand to benefit would be assessed on a pro-rata basis to pay the cost of sites and construction. The assessments would be spread over a period of years.

Boston's Underground Plans

Following the example set by San Francisco, city authorities in Boston are contemplating a 3,500-car garage beneath historic Boston Common as

The volume of traffic on city streets, already approaching prewar levels, will rise sharply when automobile manufacturers get into full production. Traffic authorities predict a 25 to 50% increase in traffic volumes in the next 15 years. Only by providing adequate off-street parking facilities, such as underground garages, multiple-story open-deck garages and parking lots scattered throughout downtown shopping areas, will it be possible for large cities to check the outflowing tide of decentralization and preserve their downtown business districts.

part of an all-out attack on the parking problem. Because of its narrow, winding streets in old sections of the city, Boston presents one of the worst traffic snarls in the country. The Greater Boston Development Committee has pointed out that nearly half of the street areas are blocked by parked cars.

Boston needs off-street parking accommodations with a capacity of 6,700 vehicles to serve its principal retail, financial, wholesale and industrial areas, the Committee reported.

The initial steps in the development of a long-range parking program for Boston were taken early in the year when the governor signed the necessary enabling legislation. One measure authorizes the city to borrow \$5,000,000 beyond its debt limit to acquire sites and construct off-street parking lots or garages, which will be leased to the highest bidder among private operators. Maximum parking fees will be fixed by the city.

Another measure authorizes the city to permit private interests to construct and operate a parking garage under Boston Common; public funds will not be involved.

Boston's parking program will be integrated with plans for a proposed express highway, known as Central Artery, which will cut through or pass near most of the city's principal traffic destinations. This controlled-access highway through the city, with adjacent parking facilities at key points, will eliminate large volumes of traffic and parked cars now cluttering Boston's downtown streets.

Baltimore's Program

Baltimore, another city whose nar-



★ This attractive parking lot is one of six municipally operated parking areas in Kansas City, Kansas

row, traffic-clogged streets are a headache for drivers, is preparing to convert the old Lexington Market, long outmoded but still a busy shopping center, into a modern structure which, in addition to shopping space, will provide parking accommodations for 800 shoppers' cars, mostly on the roof. Allowing for a turnover of three, which is not unusual for a shoppers' parking lot, the facility will accommodate 2,400 cars daily. The cost, about \$2,000,000, will be financed through revenue bonds to be paid off with earnings from shop rentals and reasonable parking fees. The building, when paid for, will revert to the city.

Baltimore business men and city officials are also considering plans for several multi-deck parking garages, with ground floors for stores and shops. These, like the Lexington Market, would be located near the central business district, on sites now occupied by obsolete structures.

At Washington, D. C.

Washington, D. C., already has several "open-deck," multiple-floor parking structures in its downtown district, which are operated by private enterprise. One large department store offers inexpensive parking for its customers in its own open-deck garage. Rapidly increasing traffic congestion in the nation's capital has convinced the city's civic and government leaders that eventually it will be necessary to construct parking garages under the Mall and under parks adjacent to government buildings and the downtown business section.

Miami Beach's Unique Solution

Miami Beach, whose traffic congestion and parking difficulties fluctuate with the seasons, has tackled its parking problem in a unique way. Having a population that varies from 30,000 to 100,000 in a single year, the city was confronted with the question of how to provide adequate parking facilities for motorists during the tourist season and at the same time avoid heavy operating costs in other seasons.

The parking meter was the answer. Instead of paying parking-lot attendants, motorists feed the meters,



★ The Downtown Merchants Parking Association in Oakland, Calif., provides free parking for shoppers, for two hours



★ This open-deck, multiple-story parking garage is operated by a large department store in Washington, D. C., for the convenience of its customers



★ Attractive display windows lure motorists who use the municipal parking lot at the rear of stores in Quincy, Mass.

some of which are adjusted for multi-coin operation. At the one large lot now in operation, parkers in the rows nearest the stores pay five cents for 60 minutes. In more distant locations, five cents buys 90 minutes of parking time. On the outer fringe of the lot, some distance from the shopping center, 25 cents provides all-day parking.

The meter system is supplemented by parking permits. During the tourist season, from October through April, monthly parking-lot tickets may be purchased for \$3.00. A ticket good for the remainder of the year also costs \$3.00.

The present parking lot, opened last December, is located on Lincoln Road and has accommodations for 368 cars. Its capacity will be expanded this fall to 960. Four additional lots will be put into operation by November. Ultimately the city intends to establish 16 municipal parking lots located at points where they will serve shopping centers, recreation areas and hotels most advantageously. The program is self-liquidating, as earnings from the meters and permits are used to defray the cost of parking-lot expansion and traffic regulation.

A Small City's Solution

Shoppers in Ottumwa, Iowa, a typical small mid-western city, have no parking troubles. A well-paved parking lot, located one block from the main intersection in the heart of the business district, affords ample parking facilities for local residents and out-of-town shoppers. The parking lot has a capacity probably not found in any other city of comparable size (32,000 pop.). The capacity of the parking lot is 1,000 cars at a time, and parking is free.

Ottumwa's parking lot did not cost the taxpayers a penny directly. Several years ago the city purchased a water works and power plant on the

riverfront, near the parking-lot site. Realizing that Ottumwa urgently needed parking facilities, the manager of the utilities proposed to the city commission that the open sewer and swamp land along the river bank be filled in, that one span of an old highway bridge be eliminated, and that an abandoned railroad viaduct be removed to provide space for a modern parking lot.

The project was completed shortly before the war. The cost was equivalent to about one year's earnings from the utility plants. As a result, Ottumwa today has adequate parking facilities and a cleaned-up riverfront. If the need arises, a second-story deck will be constructed over the parking lot to provide additional parking facilities.

Oakland's Six Lots

Oakland, Calif., is another city that has few parking problems. Back in 1929 downtown merchants and property owners discovered that the city was beginning to decentralize and that shoppers were complaining about the lack of parking space in the cen-

tral business district. Prompt action was taken to organize a Downtown Merchants Parking Association which established parking facilities attractive to shoppers. Five sites were leased and converted into parking lots, one being in the center of the business district. Another lot was opened later.

Oakland's six parking lots have a total capacity of more than 800 cars. Including night operation, the lots average a turnover of 3.07 cars per space per day. Extra lots are leased for the Christmas shopping period. Until 6 p.m. parking is free for periods of one, one and a half or two hours, depending upon lot location. After 6 p.m. 10 cents an hour is charged, with 50 cents as the maximum. To make up operating deficits, the 150 members of the parking association are billed monthly on a pro-rata basis in accordance with the number of parking tickets each merchant has validated.

Quincy Invested \$150,000

Realizing the trade value of parking facilities near the business district, merchants in Quincy, Mass. (pop. 75,000), urged the city to use municipal funds to acquire a large parking-lot site at the rear of stores along Hancock Street, the city's main thoroughfare. They pointed out that increased property values and assessments would more than compensate the city for the expenditure.

The parking lot, a tract some 1,300 ft. long, with a width varying from 100 to 300 ft., is located between a railroad and a strip of land behind the city's principal retail stores. It has spaces for 500 cars. Parking is free, and there is no time limit. The cost to the city was approximately \$150,000.

While the plan was still in its infancy, two stores spent large sums to develop attractive rear entrances, with display windows facing the lot. Other stores are planning to improve

The outstanding success of San Francisco's initial experiment in underground parking has convinced officials in the Bay City that garages below street level are the most practical and, in the long run, the most economical solution of the parking problem in downtown business districts where parking-lot sites are scarce and property values high. The city is considering plans for five more parking garages underneath downtown squares and parks, with a total capacity of 8,000 cars, or more than half the number of vehicles driven daily into the shopping districts.

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their rear entrances, and eventually the parking-lot facades will be as attractive as the "main street" fronts.

Door counts at three large stores showed that 50 to 55% of their customers come by automobile, park their cars on the lot and enter the stores from the rear. If shopping is not their immediate interest, motorists can park and proceed through short connecting streets to the main street.

The lot is open 24 hours a day. At present there are no attendants and no lighting, and parking is somewhat haphazard. But these conditions will be corrected in the near future. The lot will be brought up to grade to meet surrounding drainage levels, new pavement will be laid, lights will be installed, parking lanes will be marked out, and attendants will be placed on duty during store hours.

Surprising Data on Parking Habits

Accurate information is beginning to be available on the parking habits of motorists, their reasons for parking, the distance people walk to reach their destinations after parking a car, and the average length of time a motor vehicle remains in a parking space. Such data remove some of the elements of guesswork from plans for the expansion of downtown parking facilities. And this enables municipal authorities or private operators to decide where additional parking accommodations should be located and what the capacity should be.

Analysis of the data compiled from parking studies conducted in the downtown sections of Atlanta, Baltimore, Providence and Pawtucket revealed several significant facts in regard to the daytime parking habits of motorists in those cities.

How Long and Why

It was discovered, for instance, that 34% of the motor vehicles in downtown parking areas were parked less than half an hour, 51% less than an hour, 16% one to two hours, and 20% two to eight hours, only 13% more than eight hours.

Forty per cent of the parkers were working in the district, either as employees in stores and offices or as "transient" workers, delivering supplies or picking up merchandise for delivery elsewhere; 23% had parked their cars in order to transact business in the district; 18% were shoppers, and 19% gave other reasons for parking (to pick up tickets at railway or airline offices, visit dentist,

keep luncheon engagements, etc.).

These percentages apply, of course, to only a few cities and are not conclusive. They will vary in different cities, depending upon the size of the city and the predominant activity. From recent parking studies it appears that the average parking time in downtown sections of large cities is longer than in small or medium-size cities. A majority of downtown employees in large cities who drive to work live in outlying residential sections and therefore require all-day parking accommodations; in small cities, many go home for lunch.

Parking habits in an industrial city differ from those in a city that is the shopping center for a wide agricultural area. In the latter a larger percentage park several hours during the day for shopping expeditions. In industrial cities there is more night-time parking in the business district, since a great many workers drive downtown in the evening to attend a movie or seek other forms of recreation.

Traffic Volume Not Reliable Index

Recent traffic surveys and parking studies tend to prove that the volume of traffic on downtown streets in large cities cannot be accepted as an accurate index of parking requirements in the business district. This revelation came as a surprise to traffic engineers, who had assumed from general observation that heavy traffic on a downtown thoroughfare was convincing evidence of the need for large parking areas in the district.

The Atlanta survey showed that 65% of the vehicles entering the downtown section during a 12-hr. period were passing through the business district, traveling from one section of the city to another or headed for points beyond the city. In Pawtucket, 61% of downtown traffic was "through" traffic in Providence, 54%, and in Baltimore, 59%.

These facts were established by counting traffic at points on a cordon around the business district, and comparing the total with the number of cars parked in the downtown section, as shown by the parking survey.

In nearly all cities the main arterial routes pass through the business district, making it necessary for drivers to battle heavy traffic on streets often too narrow for the traffic load. Survey findings suggest that circumferential routes by-passing the business district should be provided for drivers who do not wish to stop in the district. A circumferential route, together with adequate accommodations

for parkers, would eliminate congestion on downtown streets.

The field work or "interviewing" phase of parking surveys was completed recently in Nashville, Tenn., Seattle, Wash., and Harrisburg, Pa. Similar studies were scheduled for Portsmouth, N. H., Portland, Ore., and Spokane, Wash.

Parking surveys referred to are Federal-aid projects conducted under the direction of state highway departments with the cooperation of individual cities and the Public Roads Administration. They are financed with state, city and federal funds. In addition, a number of surveys have been conducted independently by municipalities whose traffic authorities are keenly aware of the parking problem.

Road Speeds Are Up in N. Carolina

Motorists are averaging high speeds these days in spite of the age and conditions of cars and tires, observes a bulletin from the North Carolina Highway and Public Works Department. A state-wide semi-annual speed check made in October disclosed an average rural speed of 45.2 mph. on state highways. The prewar average was 44 mph. Twenty-three per cent were traveling faster than the state limit of 50 mph., according to data obtained without motorists' knowledge. Buses averaged highest of any class, 51.7 mph.; out-of-state passenger cars 47.9; local passenger cars, 45.6. More than 50% of all vehicles, however, drove within the most popular bracket of 39-48 mph.

Mail Inserted Card or Inquiry Blank (page 127) for Equipment Data

Again this issue of Roads and Streets carries descriptions of many new labor-saving efficiency devices and latest material developments. See our New Equipment and Materials Section beginning on page 111, for which a numbered reply card has been inserted to help you request data on items that interest you. Also on page 127 is an inquiry blank and advertisers' index which will help you get data on equipment and materials you need.

Federal Airport Act

Proposed regulations as digested by W. R. Macatee, Manager, Airport Division, American Road Builders' Association

1. "Part 550" of the (proposed) Rules and Regulations of the Civil Aeronautics Administration were issued recently for carrying out the Federal Aid Airport Program, authorized by the Federal Airport Act. (Public Law No. 377, 79th Congress, approved May 13, 1946.) Public hearings were scheduled at Washington, Oct. 28-30, concerning the proposed rules and regulations. Interested parties and organizations were given an opportunity to be heard. Written briefs, in addition, were presented up to Nov. 8.

Government Cost Share

2. As most readers of this digest of the proposed regulations realize, the Act empowers the Administrator of CAA to carry out a Federal Aid Airport Program for the development of public airports in the U. S., Alaska, Puerto Rico and Hawaii. This is to be accomplished by grants of Federal funds to public agencies, the latter sharing in the cost of development of airports in their communities. Airports so developed will stem from the National Airport Plan now being formulated.

State Officials Participate

3. The regulations make clear that the views and recommendations of state and local aviation officials will be given every consideration in formulating and revising the National Airport Plan.

Plan Deadline

4. CAA's Administrator is expected to announce the National Airport Plan of 1947 on Dec. 1, 1946, and it will be revised yearly thereafter about Nov. 1. Such plans will outline the Administrator's judgment of locations where public airport development is needed during the next three years. The Act authorizes \$500,000,000 Federal aid for airport development in the U. S. over a 7-year period; annual appropriations cannot exceed \$100,000,000. In addition, \$20,000,000 were authorized as Federal aid for airport development, over the

same period, in Alaska, Hawaii and Puerto Rico. The 7-year period dates from the fiscal year ending June 30, 1947.

Administrative Expenses Are Deductible

5. Before any funds that may be appropriated are allocated or apportioned, there shall be deducted the portion specified (estimated 5%) in each appropriation act, to be used for necessary planning, research and administrative expenses. The remainder will be available for grants for the purpose outlined, airport development.

Regulations Define Terms

6. The proposed rules and regulations contain CAA's definitions of various terms involved in carrying out the Act. Among other things, it lists *improving or repairing* a public airport as "Airport development"; however, it seems unlikely that this means day-to-day maintenance will be considered as an allowable cost in which Federal aid might participate. The rules define "Program" as lists of projects proposed to be undertaken during the next fiscal year, except that those in the current year (1947) are to be undertaken this fiscal year, which began July 1.

Before an airport development project may be considered for inclusion in a Program, a Project Request must be filed by a sponsor or applicant.

Filing does not necessarily assure a project's inclusion in a Program, nor does it obligate the sponsor or applicant to "go through" with acceptance of a Tentative Allocation. No consideration can be given to a Project Request unless the project is included in the then current revision of the National Airport Plan.

CAA-Standards and Approval Required

7. Throughout the regulations, it is made plain that sponsors or applicants act as the owner of airport development projects on which Federal aid funds may be granted, and as such

serve as the principals in (a) acquiring land and easements for approved airport development projects, (b) developing plans and specifications, (c) advertising for bids for airport development, (d) awarding contracts for and supervising construction, (e) as airport operators, and (f) maintain it.

Equally clear throughout the rules is the fact that the CAA, or its representative, can be expected to exercise careful and close supervision of each step involved in executing the development, seeing to it that CAA-standards shall govern in all details. The rules lay down strict requirements to assure compliance with high standards, and proper accounting for the purpose of determining sponsors' and the U.S. shares of allowable project costs, also to insure the Government's interests and rights being protected at all times.

Any Public Agency May Submit Applications

8. Any public agency (or two or more jointly), may submit a Project Request or Project Application, except when the law of any State prohibits public agencies in such states, making such requests or applications. In such cases, the state may act as applicant in behalf of the sponsor. Sponsors shall satisfy the Administrator they have available, or obtainable, sufficient funds to meet sponsors' part of project costs, and to operate and maintain an airport. A Sponsor must hold, or be in position to hold, title to land, including easements necessary for its airport, except the sponsor may hold a long-term lease of land and easements from another public agency.

In certain well-defined cases, limited encumbrances against the landing area and buildings are permitted if, in the judgment of CAA's Regional Administrator, they will not interfere with the operation of the airport. In some cases, sponsors of airports may lease certain portions of airports, but such leases must be careful to preserve the usefulness of airports.

Applicants May Act for Sponsors

9. An "Applicant," such as a State, for instance, might act in behalf of a sponsor, such as a municipality, for instance, in filing a Project Request, which is a preliminary expression of interest in seeking Federal aid; or, it might also set in behalf of a sponsor in filing a Project Application, which is a formal, detailed application for a grant of Federal funds. Project Applications (Form ACA 1624) are submitted to CAA's Administrator (through CAA's District Airport Engineers) after Tentative Allocations of Federal funds have been made for projects. Such allocations are withdrawn if the sponsors or applicants fail to submit Project Applications, or otherwise fail to conform to the requirements. Sponsors or Applicants have 60 days to accept or reject Grant Offers. In certain cases, sponsors or applicants may seek to have grants increased, but such efforts must be accompanied by complete justification therefor.

Wide Range of Apportionments

10. Regulations issued today show percentages for apportionment of 75% of Federal aid funds among the states; this is based on a Population/Area formula, except those projects in certain states where there are Indian and non-taxable lands. Projects in the latter states are entitled to slightly larger Government sharing of costs, ranging up to 62½% for construction costs on projects in Nevada, and somewhat less in other states containing non-taxable lands. Apportionments range (percentage-wise) from 0.140066% in Delaware to 6.725518% in Texas.

All Federal aid funds apportioned to states remain available until June 30, 1953, unless sooner expended. An exception concerning the Government's maximum share of costs is on projects located in Alaska; there the Government's share runs up to 75%. In general, the U.S.-share of airport development costs—those projects which receive grants—is 50% for the construction phases involved on Class III and smaller airports.

Discretionary Fund

11. As shown, 75% of net Federal aid funds appropriated for airport development in the U.S., are apportioned to the states on a Population/Area formula. The balance, or 25%, constitutes a discretionary fund which CAA's Administrator may use as the U.S.-share of allowable project costs of approved projects, regardless of state lines. Discretionary funds will not be used if

regularly apportioned funds are available in the state involved.

In distributing discretionary funds, the CAA will take into account (a) airport facilities and needs in all states; (b) the tentative program formulated annually, and its relation to available funds in given states where airport facilities may be needed urgently. Discretionary funds are not available to pay any part of sponsor's share of project costs. This rule applies especially to projects sponsored by Federal agencies. Roughly, the funds authorized are divided as follows:

Administrative expenses	\$ 25,000,000
Regular apportionments	356,250,000
Discretionary funds	118,750,000
Total	\$500,000,000

U. S. Share for Class IV Airports

12. The Government also shares in construction costs of approved Class IV and larger airports. However, the percentage of its share in such costs differs from its share of construction costs on smaller projects. Except in those states where more than 5% of area consists of non-taxable lands, the Government's share of construction costs on large airport projects ranges from 50% for the first \$2,000,000 cost, down to 5% for that portion exceeding \$10,000,000. For the purpose of making these cost-determinations, and therefrom determining the U.S. share of allowable project costs (other than cost of land acquisition) prior allowable project costs under the Act are taken into account.

Sliding Scale U. S. Share

13. The table below gives the U.S. percentage share of allowable costs (except for land acquisition) on Class IV or larger airports in most states, and examples in some states having more than 5% of non-taxable lands:

Increments of Cumulative Allowable Costs	Most States	Calif.	Colo.	Nev.	Wash.	Wyo.	Alaska
First \$2 million.....	50	54.12	53.34	62½	51.88	57.47	75
Next \$1 million.....	45	49.12	48.34	57½	46.88	52.47	70
do	40	44.12	43.34	52½	41.88	47.47	65
do	35	39.12	38.34	47½	36.88	42.47	60
do	30	34.12	33.34	42½	31.88	37.47	55
do	25	29.12	28.34	37½	26.88	32.47	50
do	20	24.12	23.34	32½	21.88	27.47	45
do	15	19.12	18.34	27½	16.88	22.47	40
do	10	14.12	13.34	22½	11.88	17.47	35
Exceeding \$10 million.	5	9.12	8.34	17½	6.88	12.47	30

Land Costs

14. The Government's share in land acquisition costs (including easements and interest in land) shall be 25% of the allowable land costs, regardless of size of airports.

District Engineer Is CAA's Contact

15. In general sponsors and applicants carry on their negotiations with CAA's District Airport Engineers in

all matters pertaining to Federal aid for airport development. District Airport Engineers are to be located in 42 of the states, at State Capitals.

Planning Reviewed

16. Whereas CAA's District Airport Engineers are CAA's contact representatives in practically all matters pertaining to the Federal Aid Airport Program, the regulations, nevertheless, make ample provisions for reviews of planning decisions. In such cases, Regional Administrations are authorized to investigate and hold public hearings concerning such matters.

If the Regional Administrator upholds previous planning decisions, the qualified person or firm filing against the original decision may (within time limits) request the Regional Administrator to forward the record to the Administrator for his review of the matter. The Administrator bases his decision on the record, without public hearings.

Protests Against Locations

17. Sponsors or applicants submitting Project Applications shall publish in local papers details concerning same; and any person or concern having a substantial interest in the project may file a memorandum in support of, or in opposition to the project, doing so through the District Airport Engineer. And such persons or concerns may request a public hearing with respect to the location of the airport. Such requests must be filed in a specified time.

If a hearing is granted, it will be conducted by CAA's representative, affording a fair exploration of the question. Decisions will be based on the record presented, and parties concerned will be notified by CAA con-

cerning the nature of the decision.

"Sponsor's Assurance Agreement"

18. If and when CAA's Administrator makes a tentative allocation for a project, sponsors must execute Form ACA 1642, "Sponsor's Assurance Agreement." This is a lengthy and detailed document, and must show that the sponsor has the legal power and financial ability to assume the



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sponsor-share of project costs. It must also show ownership-status and location of land on which the airport development project is to be located. If Federal grants are made for partial development of a project, the remaining portion of the work must be completed within five years subsequent to completion of the first phase. Otherwise, the sponsor must refund Federal grant that might have been made.

Aircraft Fuel Facilities Cost

19. The regulations list numerous types of construction work which shall be eligible in a project, including, among other items, (a) drainage, on or off the airport site; (b) dredging of seaplane anchorage; (c) construction, alteration and repairing of access roads and walks, on or off site; (d) construction of utilities, on or off site; (e) installation and repairs of aircraft servicing facilities, such as storage and dispensing facilities for aircraft fuel. The regulations make plain that the cost of hangars or living quarters for personnel is not considered an allowable item in which Federal aid might participate. Nor is purchase cost of equipment used in force account work considered allowable.

Also outlawed are expenses incurred prior to approval of the Act, May 13, 1946. Interest charges are not allowable. On the other hand, the cost of a wide range of engineering services in connection with carrying out a Grant Agreement may be borne in part by the Government.

Force Account Discouraged

20. In certain cases, if specifically approved by the Administrator of CAA, work by sponsors of airport development projects may be accomplished by force account. Rental for equipment used on force account work may not exceed two-thirds of the prevailing local rate of rental of such equipment, and the use of such equipment for force account work must be specifically approved by CAA. If and when force account work is authorized, on non-Federal projects, or outside of Hawaii, Alaska and Puerto Rico, the U.S.-share of the cost on any one project shall not exceed \$15,000 in any one-year-Program.

Construction by Contract

21. Open and competitive bidding is required when work is done by contract. Sponsors or applicants award contracts, subject to approval of CAA's District Engineer, and he must approve any change in contracts. Invitations for bids are issued by sponsors or applicants after

the Administrator has approved plans and specifications. Minimum wage rates established by U.S. Secretary of Labor shall obtain. Ordinarily, awards must be made to lowest responsible bidder, using Form ACA 1631. No bid may be accepted without CAA-approval. CAA's Regional Administrator shall first approve the sponsor's "Recommendations for Awards"; sponsors shall award contracts, using Form ACA 1636.

Bonds Required

22. A Performance Bond, and a Payment Bond (Forms ACA 1638A and 1638B) are required of the contractor. The latter is for security of persons doing work or furnishing materials on approved projects. In general (depending on State laws), these shall be 50% of the contract. Contractors are required to carry ample insurance of various forms, including Public Liability and Workmen's Compensation insurance. Bidders are required to submit Bid Bonds equal to 5% of the bid, or a certified check (payable to the sponsor) equal to 5% of the bid.

Contractor's Employment Requirements

23. Veterans shall be given preference in employment by contractors; convicts can not be employed. The Kick-Back Statute and Regulations apply, and special emphasis is given to their application. Adequate safety provisions for the protection of workmen are mandatory.

Depository and Payments to Contractors

24. If and when a Grant Agreement is made, and a "Sponsor's Assurance Agreement" has been executed, the sponsor or applicant shall designate a depository for Federal-aid funds and deposit them therein to cover U.S. share of project costs. The sponsor or applicant may withdraw such funds for payment of project costs. Payments to contractors shall be made by the sponsor or applicant. Payments for estimated work performed may be made at such times as agreed upon, but 10% must be retained until at least 50% of the work has been completed, after which full payments may be made if the work progresses satisfactorily, but sponsors or applicants must retain the prior withheld sums until final payment is authorized. Prior to final payments being made, contractors must execute a Certificate and Release on Form ACA 1643, and the sponsor or applicant will furnish the District Airport Engineer a Certificate of Completion on Form ACA 1640.

Significant Terms

25. The rules and regulations include a group of highly significant terms which, as operation of the Act goes on, will become familiar and important. A partial list is named below:

A **SPONSOR'S ASSURANCE AGREEMENT** is the crux and epitome of Government-Sponsor relationship—"the tie that binds" for a 20-year period.

A **PROGRAM** is the yearly scheduling of projects, based on receipt of sponsors' or applicants' Project Requests.

The **NATIONAL AIRPORT PLAN** is the over-all plan for a country-wide system of useful public airfields, made up by CAA to cover the foreseeable aeronautical needs for a 3-year period, and subject to yearly revisions.

A **PROJECT REQUEST** is a sponsor's or applicant's informal expression of interest or desire to participate in the Federal Aid Airport Program—a "feeler."

A **PROJECT APPLICATION** is a sponsor's or applicant's formal, detailed application for a grant of Federal funds—"the real thing."

A **SPONSOR** is one or more public agencies which will have control of an airport to be developed—the owner.

An **APPLICANT** is a sponsor, or a public agency (such as, for instance, a State) which acts on behalf of a sponsor (such as, for instance, a municipality) in submitting Project Requests or Project Applications.

A **TENTATIVE ALLOCATION** is CAA's Administrator's notice of an allocation of Federal-aid to a sponsor or applicant.

An **OFFER** is made by CAA, stating a definite amount the Government will assume in a project's cost. These are sent to sponsors or applicants.

A **GRANT AGREEMENT** is CAA's offer to have the Government assume a share of project costs, plus sponsor's or applicant's acceptance thereof.

Eight Major Steps Required

26. There are eight major steps required for a sponsor's project to participate in the Federal-aid Airport Program:

1. *The location must be included in the then current National Airport Plan. This is made up by CAA, after careful study of the country's 3-year fore-seeable aeronautical needs.*

2. *A sponsor (or an applicant, acting in a sponsor's behalf) must file a Project Request through CAA's District Airport Engineer, to have a given project included in the upcoming yearly Program. Use Form ACA*

1623. This does not necessarily obligate CAA to so program a project; nor is the applicant bound.

3. If the project is selected, CAA makes a Tentative Allocation, advising the sponsor or applicant on Form ACA 1641, forwarding it through the appropriate District Airport Engineer.

4. A Project Application is then filed with CAA's District Airport Engineer by the sponsor or the applicant, using Form ACA 1624, after receipt of Form ACA 1641, above.

5. CAA, if satisfied that all regulations have been met, approves (4).

6. Administrator then makes an Offer on Form ACA 1632 to pay U.S. share of cost, and upon its acceptance it then becomes the Grant Agreement.

7. After the Grant Agreement has been duly executed, and before the U.S. is obligated, a "Sponsor's Assurance Agreement" must be executed by the sponsor, using Form ACA 1642.

8. Sponsor then proceeds to perform all necessary construction work, adhering to CAA's standards, policies and procedures.

Regulations Clear-Cut

27. Even though the proposed rules and regulations may, at first glance, appear complex, and bound up with red tape, a careful study reveals that they are workable and intelligible. The safeguards which are included to insure the rights and interests of the government being protected are, it should be remembered, made mandatory by the terms of the Federal Airport Act. Such safeguards are customary in regulations governing the carrying out of Federal aid terms for other purposes where such aid is granted, such as, for instance, the Public Works program, and the Lanham Act Program. Moreover, CAA's informal hearing (Oct. 28-30) are expected to clarify any misunderstandings of the regulations, and lead to such changes as might be shown necessary and desirable.

Official Copy Coming

28. This bulletin gives you a digest of proposed rules and regulations governing matters pertaining to carrying out the Federal Aid Airport Program. We shall shortly send to each of our members a complete copy of the official Rules and Regulations governing the Act, except Sections 16 and 17 thereof. Those sections have to do with the possible use of Government-owned lands on airports, and (17) "Reimbursement for Damage by Federal Agencies to Public Airports." Those sections will be subjects of separate regulations by CAA.

O. J. Porter Forms Consulting Firm

O. J. Porter, soils engineer recently on the Army Engineer's Board of Consultants on airfield runway design and for 23 years with the California Division of Highways, has entered private consulting business under the name O. J. Porter and Company, Sacramento, California. The firm will specialize in foundation, pavement and drainage problems.

Mr. Porter, who is the author of numerous technical papers, is identified with the California Bearing Ratio method of designing flexible pavements, soil compaction, and the development of vertical sand drains for hastening and controlling consolidation of unstable foundations. It is understood that sand drains are being considered in connection with several very large dam projects both in the east and the west.

Among the current activities of the organization is a technical research contract with the U. S. Engineers at Stockton, California, where test pavements are being subjected to repetitions of plane wheel loadings up to 200,000 lb. to aid in developing better criteria for extremely heavy runway design.

Associated with Mr. Porter are W. H. Jervis, H. R. Cedergren and B. D. McCreary. Mr. Jervis was formerly head of the soils and embankment section of U. S. Waterways and Experiment Station at Vicksburg, Miss., and prior to that, head of soils in the U. S. Engineer Vicksburg district, specializing in dam and levee design.

Mr. Cedergren was formerly in charge of soils for the Portland district of U. S. Engineers. In addition to experience on airports he is a specialist on seepage and theoretical

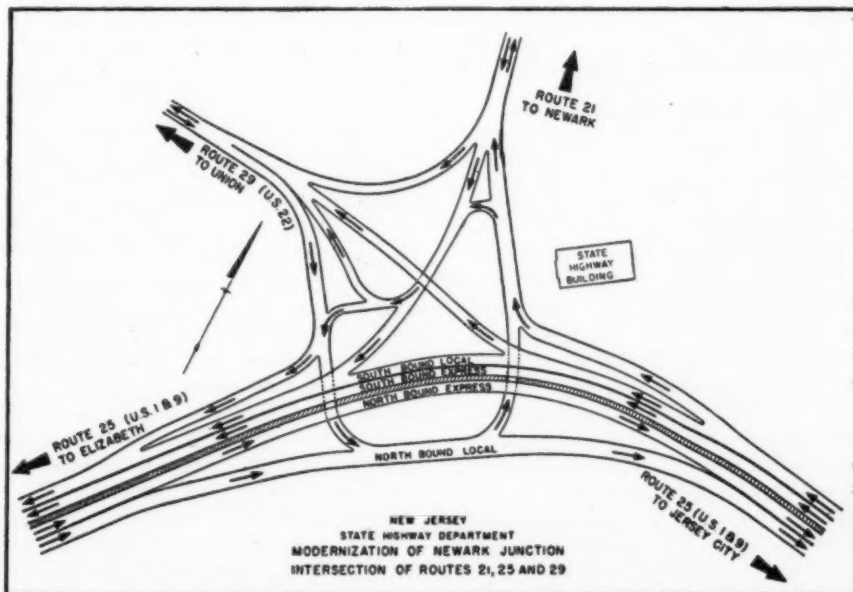


phases of earth dam design. Mr. McCreary is a graduate geologist with wide experience in Mexico and as a geologist with the California Division of Highways, during the past six months being in charge of the foundation investigational work which the firm is conducting for the Navy at Guam. Mr. Porter recently returned from a twenty-day trip to the Island.

Newark Junction Intersection Being Modernized

Reproduced here as an example of interesting intersection design, this drawing shows how the New Jersey state highway department is modernizing the complicated junction of state routes 21, 25 and 29 at Newark. The reconstruction, in accordance with modern standards, will go far toward relieving traffic congestion and reducing accidents at this location.

The work is being carried on as part of New Jersey's general reconstruction of Route 25 between Elizabeth and Newark. Contractor, Poirier and McLane.



Highway User

Gets Spotlight at Highway Transportation Congress

Highway engineers and officials (and contractors, too): pause and read what you, the real bosses, the motorists and truckers, are thinking these days

DELEGATES from 40-odd states and representatives of more than 1,000 National and State organizations attended the initial meeting of the Highway Transportation Congress held at the Mayflower Hotel in Washington, D. C., Sept. 26 and 27. The addresses made by national celebrities as well as the discussions which took place at the various committee meetings, emphasize many important aspects of highway design and construction as seen from the viewpoint of the nation's highway users. The congress served to emphasize the necessity for close co-operation between this group and the nation's highway engineers and its construction industry. The reports and recommendations of the committees—on highway planning, financing and administration, highway safety, removal of highway barriers to interstate commerce, and size and weight restrictions—can be expected to have a direct bearing on future planning and construction of the nation's highways.

Sloan Keynotes Congress

Alfred P. Sloan, Jr., chairman of the board of governors and the chairman of the National Highway Users Conference opened the Congress. In stating the purpose of the conference, Mr. Sloan pointed out that the papers to be presented and the discussions planned were designed to develop a realistic point of view of the importance of the highway as a factor in the American scheme. And further, to attempt to appraise our present and future needs in terms of broad principles involved, in the hope of formulating a positive program of policy and action that will serve to increase the effectiveness of "transportation by highway" as an

instrumentality of progress in the evolution of our social and economic life.

In discussing the current situation, Mr. Sloan brought out the fact that the automotive industry is beset by all manner of limitations. Their operations cannot be carried out on the basis of what they would like to do; what they have planned to do, or expected to do, but rather by what they are permitted to do. Calling for faith in the future he concluded, "Somehow, even at great cost, unreasonable delay, the weakening of our economic position, and the acceptance of much less than we might have, we will, I believe, overcome the difficulties that face us at the moment—at least in degree."

An American Crisis

Mr. Harold S. Buttenheim, editor, American City Magazine, brought out many pertinent facts which have a bearing on the important aspects of every community's economic and social well being in his address on the subject of "City Highways and City Parking—An American Crisis." Mr. Buttenheim observed that no model city exists in the nation and that all communities are now paying for the lack of previous planning. Increasing decentralization on the part of business is the net result of our failure to provide suitable parking facilities. Bringing out the fact that under present day conditions distances are now measured in minutes not miles and all cities have parking and congestion problems in common, Mr. Buttenheim expressed the opinion that most courses of action now being considered such as by-pass routes for through traffic, parking meters and the like, while helpful palliatives are not a solution to the problem.

He recommended the use of the services of more and more traffic engineers and the use of mass transportation for access to congested areas.

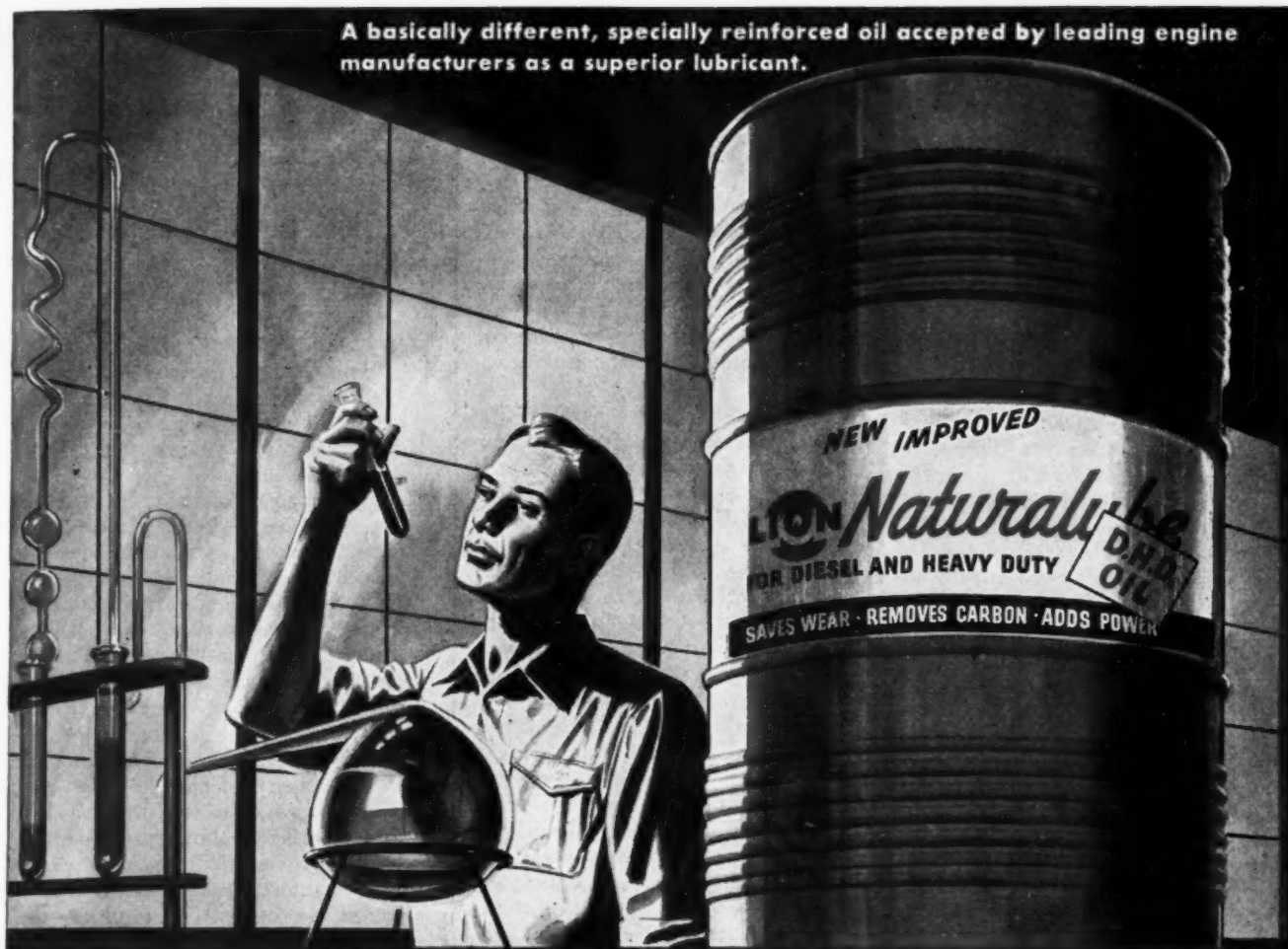
Federal Contributions Have Dangerous Aspects

Warning against over-extension of Federal contributions to highways, Charles L. Dearing of the Brookings Institution in an address on "How We Pay For Our Highways," said such a trend carried to excess might jeopardize the future solvency of American Highway management.

While acknowledging the sound justification for defraying a small portion of the total highway bill with general funds of the Federal treasury, Mr. Dearing said, "It should be obvious that when federal contributions exceed the amount necessary to accomplish these national objectives it will eventually become necessary to make highway users directly responsible for the additional outlays." Dearing pointed out that during the 1920's federal expenditure never exceeded 6% of the total outlay for roads and streets, but that by 1940 the proportion had risen to 28%, with current pressures in the direction of still greater federal contributions.

Discerning two disturbing trends, Mr. Dearing said "Today, therefore, we are faced with the formidable task of virtually rebuilding our road and street system in order to realize the full potential economy, and safety of automotive transportation. That task will require staggering amounts of money. The issue is whether or not the methods developed during the past 25 years will produce the required funds and achieve the necessary results—with equity. In my judgment these methods will fail unless two trends are checked or re-

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versed. First, dissipation of user funds must be stopped, and second, federal aid must be restored to its original and valid role." Mr. Dearing concluded that the future solvency of American highway management will depend in large on the manner in which our policy makers face up to the problem implicit in the dissipation of user revenues and in the trend to over-extension of federal authority and responsibility.

Safety Training—An Educational Requirement

Declaring the 30,000,000 students in American schools offers the greatest hope for the solution of the traffic accident problem, Mrs. L. K. Nicholson of the National Congress of Parents and Teachers, called on educators to meet this challenge even at the expense of dropping a subject from the present curriculum.

Speaking on the subject of "The Educators' Urgent Responsibility in Highway Safety," Mrs. Nicholson pointed out that the 30,000,000 student body represents a "reachable" group that should be given guidance in accident prevention, and upon their ability to shoulder responsibilities involving traffic will depend the success or failure of traffic accident prevention for years to come.

Synthetic Rubber Promising

American produced synthetic rubber can be the means to effect a reduction in the higher arbitrary price of crude natural rubber which the United States is paying at far Eastern ports, John L. Collyer, president of the B. F. Goodrich Company, said in an address entitled "America's Policy on Rubber." Mr. Collyer predicted that the production of tires in 1946 should be about 85,000,000 units, more than 40% above 1940.

"If production continues at the present high level," Collyer said, "the supply will be sufficient to satisfy the pent-up demand during the early part of next year. I use the word 'if' because of possible shortages of component materials and possibility of another epidemic of strikes."

Rural Roads Discussed

With farmers of the nation constantly producing larger quantities of raw materials basic to industrial production, it is essential that they be served by an expanding network of rural roads, Albert S. Goss, master of the National Grange, said in his address on "American's Stake in Rural Roads."

Goss expressed the opinion that a constantly expanding network of

Action Program Outlined in Highway "Users" Publication

A positive program for highway transportation, based on the policies of the National Highway Users Conference and reflecting recommendations of the First Highway Transportation Congress, is announced in a publication released today by the National Highway Users Conference. Mr. Arthur C. Butler, Conference Director, stated that the publication, entitled "A positive program for Highway transportation," presents a summary of the outstanding highway transportation problems before the nation today and recommends for each problem positive action toward its solution, which can be taken by highway users in their own communities and states.

Among the current problems on which programs are offered are: sound and adequate construction of highways based on actual need; increased necessity for highway safety education and law enforcement; continuation of the present federal aid program for state-owned highways; repeal of present federal automotive excise tax laws and the safeguarding of highway funds for highway purposes; simplification of present restrictive regulations hampering motor vehicle operation; increased reciprocal agreement among the states; and immediate legislation to insure liberalization of present vehicle size and weight restrictions on a sound basis. The booklet is fully illustrated and will have a wide initial distribution in the automotive and related fields.

rural roads connecting with an adequate system of arterial highways is essential to any well rounded program for general economic development. He urged that a definite long-range plan for a farm-to-market road system, extending over a period of 5 or 10 years, be adopted by county authorities. "To accomplish this," he said, "the Grange has recommended to its 8,000 local and county groups that county committees be set up to study the road needs and to confer with the county and township road authorities in developing such a high-

way program. We advocate public hearings under the joint auspices of such committees where the whole problem can be discussed and a plan adopted which will assure the best possible network of roads obtainable from the available funds."

State Laws—Trade Barriers

Declaring highway barriers are a threat to the American standard of living, William L. Chenery, publisher of Collier's Weekly, called on public opinion to defend a free market between states, unhampered by barriers and discriminations in his address "Highway Barriers, a Threat to Our Society."

"Obviously," he said, "the American standard of living could not endure if the great American market were divided into 48 component parts. If, to be specific, the automotive industry had to operate in the United States as the automotive industries of Belgium, the Netherlands, Norway, Sweden and other small sovereign states do operate, motor cars would be as scarce and as restricted in their use here as in Europe."

Chenery pointed out that the war brought about voluntary co-operation between the states to eliminate highway barriers between the states so far as trucks and highways are concerned. These gains can be retained, he believes, through interstate co-operation commissions and an informed public to defend the freedom we enjoy.

Diversification of Highway Funds

Outright repeal of the Federal excise taxes imposed on highway users, which for the year 1945 aggregated \$650,166,000, was advocated by Albert Bradley, executive vice-president, General Motors Corporation. Mr. Bradley spoke before an enthusiastic banquet audience on the subject, "Highway Transportation—The Road Ahead."

Motor vehicle owners not only have been contributing to the states their full share of the cost of highways, but for years have been making very substantial overpayment in Mr. Bradley's opinion. Federal excise taxes, super-imposed on the payments to the states, exact from motor vehicle owners a disproportionate share of the general tax burden, he added.

The spotlight industrialist drove home the following points:

1. Maintenance and reconstruction of the country's highway plant are urgently required at many points. Unless every state has a sound long-range program for highway improvement, development will be seriously

(Continued on page 105)

Get Loaded — Get Going

That last half-minute spent in heaping load costs contractor plenty if the haul is short or if it brings spillage; but full loads become more profitable as the haul increases

By D. K. Heiple

Field Engineer,
R. G. LeTourneau, Inc.

HIGH on the current list of acute war and strike-born shortages is that of vitally needed construction equipment. The excavation contractor today who is faced with this dire condition is also confronted with a pent-up demand from all sides that he move dirt, millions of yards of it. Roads, airports, dams, levees, every conceivable dirt job held in check for the past five years is now making its bid for the available equipment. Every piece of it, old and new, is rolling, moving dirt, but there just isn't enough to go around.

How then can the most work be done—that problem faces every contractor. The solution, obviously, is to move more dirt with the same equipment. Better planning, finer coordination, more efficient operation is therefore the only answer, and in the end, means greater profits for the contractor.

Let's get down to cases. Take a typical carrying-type scraper operation for example. The work cycle with one of these units consists of load, shift gears and accelerate, haul, spread, turn and return. Time is the prime element. How can we reduce it? Traveling time, which is generally the major part of the cycle, has been sharply cut during the past few years by high-speed rubber-tired units. Haul roads have had to be improved to take advantage of that speed. We've come that far, but where else can we whittle off a few costly seconds? Next to traveling, loading ordinarily takes the greater percentage of total time. "How long should it take to load?" we are often asked. Of course many exceptions exist, but most scrapers if properly matched to tractive power can be heap-loaded in 1 to 1½ minutes. Pile the dirt in until you have a capacity load, but when material spills or windrows it is time to pick up the blade and get going. Fighting the load for that last bushel of dirt doesn't pay off . . . *It Costs You Time and Money!*

Let's see just what it means in yards per hour. On a 1,000-ft. one-way haul under normal conditions and over good haul roads with negligible grades, just what does an extra 0.5 minute amount to if spent in spilling or bulldozing dirt with the scraper?

This shows a saving in time of 60 hours. The job is wrapped up in a week to ten days less time, which not only gives the contractor time to undertake more work in one season but actually results in a considerable saving of money. Under present price

Rubber-Tired Self-Propelled 15-Yd. Scraper

Pay yards per load in common earth—12.

	Case No. 1	Case No. 2
Load	1.0 Min.	1.5 Min.
Spread5	.5
Turns5	.5
Gear shift and acceleration	1.0	1.0
Travel 1000 ft. and return @ 14 M.P.H.	1.6	1.6
Total Cycle	4.6 Min.	5.1 Min.
Trips per Hour on 83% Efficiency (50 Min. Hour)	11	9.8
Pay Yards per Hour	132	118

Assuming a 200,000-yd. project with three self-propelled 15-yd. scrapers and one 100 HP pusher tractor:

	Case No. 1	Case No. 2
3 Machines—Pay Yards per Hour	396	354
Time to Complete—Hours	505	565



★ Here valuable time is being wasted as operator continues to force dirt over the sides and ahead of the blade in order to pack in a little bigger pay load. The high-speed unit's greatest advantage is being nullified, for which the contractor must pay in time and money




★ A high-speed rubber-tired scraper unit breaks contact with pusher-tractor as it prepares to pick up its heaping load and head for the fill. Note that bowl is heaped but that time has not been wasted in fighting the load for another costly yard of dirt . . . smart operation . . . it pays off!

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PNEUMATIC TIRE MOUNTED
TRAVELING MIXING PLANT



- ★ As MANEUVERABLE as a motor patrol
- ★ Road SPEEDS 2 to 14 miles per hour
- ★ ONE MAN operated
- ★ Handles up to 4 cu. ft. windrows
- ★ Mixing speeds from 11.5 to 71 feet per minute
- ★ 100 to 150 tons of mix per hour
- ★ Ideal for SMALL JOBS with BIG JOB capacity

The Model 36 incorporates all of the proved features of the famous Wood Roadmixers, Models 48 and 54, plus maneuverability, speed and self-propulsion. Ask your local Wood Roadmixer Dealer or write direct to the Wood Manufacturing Company for your copy of Bulletin 36. It gives complete details and specifications on this sensational, self-propelled traveling mixing plant. 2-36



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and wage scales, and with the equipment group mentioned, this can amount to approximately \$1,300-\$1,500.

Up to now we have been considering that the scraper is full and the operator is trying for yardage that has no place to go. Suppose in the additional time another yard can actually be forced into the bowl. Under these circumstances, haul length will govern the practicability.

In our previous set-up it would mean:

	Case No. 1	Case No. 2
Yards per Load.....	11	12
Loads per Hour.....	11	9.5
Pay Yards per Hour.....	121	118

We will have a yardage differential in favor of fast loading.

However, as the haul increases, it may become more profitable to take .5 to one minute longer to load, provided an extra yard or two may be obtained. At 5,000 ft. a production comparison shows:

	Case No. 1	Case No. 2
Load	1.0 Min.	2.0 Min.
Spread5	.5
Turns5	.5
Gear Shift and Acceleration.....	1.0	1.0
Travel 5000 ft. and Returns.....	8.3	8.3
Total Cycle	11.3 Min.	12.3 Min.

Yards per Load	11	12
Trips per Hour on 83% Efficiency.....	4.4	4.0
Pay Yards per Hour.....	48	48

If two Yards can be Gained:		
Yards per Load.....	10	12
Trips	4.4	4.0
Pay Yards per Hour.....	44	48

So we see as hauling time increases it may possibly be smart operation to get that last yard at the expense of a little additional time. Moreover, experience still shows that with properly matched power, a scraper can be loaded in 1 to 1½ minutes, so, at this point dirt should be boiling over the top or dozing before the blade—and that's the time to get going.

If loading time runs consistently over this recommended period and yet considerable material is actually being gained we must look deeper into the problem. The loading time specified above assumes:

1. That advantage is being taken of any opportunity for downhill loading.
2. That in level terrain passes are made both ways in the cut to save tractor travel.
3. That chain loading (swinging pusher from behind loaded rig to second one pulling up alongside) is practiced where possible to reduce tractor maneuvering.
4. That very tough materials are prepared for scraper loading by rooting.
5. That tractor and rubber-tired equipment operators are experienced dirt men, familiar with the equipment.
6. That the power applied is matched to the job required of it. In the time allotted, one pound of drawbar or rimpull will load about one pound of dirt.

Today careful planning and efficient operation pay off in dollars and in precious time. This is true not only in loading, but in all phases of the job. Each contract is a problem in itself, so no hard and fast rule can be applied to all jobs. However, if your machines are not loaded in 1 to 1½ minutes, look first to the operation. Don't waste unnecessary seconds in the cut, for payment is not made on dirt dozed or spilled by a scraper. Get that load and get going.

Indianapolis plans thirteen railway grade separations in a \$4,500,000 program the first of which was let recently. Traffic counts were made to establish a priority basis for the work. One crossing analysis showed that 187 trains passed daily, halting 12,000 vehicles.

(Continued from page 102)

retarded and millions of dollars of motor vehicle taxes will be dissipated.

2. Immediate efforts must be applied to bring about increased highway safety.

3. Increases in the number of motor vehicles and in traffic volume during the next decade should produce sufficient state highway user revenues at current tax rates to finance the highway users' share of the highway program.

Taking sharp issue with those who have alleged that "the highway system is being furnished to highway users in large part gratuitously," the automotive industry spokesman quoted from the report of the late Joseph B. Eastman, Federal co-ordinator of transportation and one-time chairman of the Interstate Commerce Commission—a report based on an exhaustive study of all forms of transportation.

"The Eastman report," he said, "demonstrated conclusively not only that highway users were paying their way but that they had actually made very substantial overpayments during the decade preceding the study."

Mr. Bradley urged that three factors be kept "uppermost" in consideration of post-war highway construction projects; "First, the need; second, the planning of sound programs; third, the ability of the taxpayer to foot the bill."

Florida Restoring Airmarkers

Crews of the Florida state road department are presently engaged in the restoration of airmarkers on the highways, according to chairman F. Elgin Bayless. About 33 members will be restored in the next few months in cooperation with the state improvement commission, and since last April 34 airmarkers have been erected out of the 1,081 obliterated at the start of the war on orders of the War and Navy Departments. Except for the markers being restored by the State Road Department, the markers are being sponsored by cities and counties and various civic organizations in the local communities. The Florida State Junior Chamber of Commerce, the Florida Air Pilots Association and other groups are taking an active part in the restoration program.

The State intends to file a claim for about \$90,000 with the Federal Government for funds to restore the 1,081 state-owned airmarkers under section 17 of the Federal Airport Act passed by the last Congress.



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Hartford Publicity Builds Public Support of Snow Removal Job

MANY commissioners who do an outstanding job of snow removal every winter get too little public appreciation for their work, even in their own communities. Taxpayers fail to understand the difficulties they face, and either forget about the commissioner entirely, or remember him only when they want to register a complaint.

Royal W. Thompson, Superintendent of Streets in Hartford, Conn., changed that situation last winter. Using stories in the newspapers and an interview over the local radio station, he told Hartford residents that he intended to keep local streets snow and ice-free throughout the winter by putting rock salt on them. He explained how the salt worked, told them how much money it would save the city, pointed out the better and faster service it would provide.

As a result of his efforts, nationwide attention was focused on Hartford. Newspapers in and out of the state called attention to the good job Mr. Thompson was doing. Hartford's bus company, local merchants, and individual motorists all praised the efficiency of his Department's work. Letters and telephone calls came from officials in other cities asking for information about his snow removal techniques. On the strength of the reputation Hartford achieved, he was invited to explain his methods to a state highway safety conference called in Hartford to "discuss respective experiences in snow-clearing with the objects of evolving a practicable program for suggestion to other cities."

In his efforts to let the public understand what he was doing, Mr. Thompson talked so much about rock salt that it became a standard gag in downtown restaurants to hide the salt shakers when he ordered his meals. Hartford's two newspapers began calling him Salty Thompson and ran editorials that began like this one: "Hats off to Royal W. Thompson, Hartford's Superintendent of Streets. From the moment the first flakes of snow began falling early Wednesday morning he got everything into readiness to cope with what might develop. He anticipated the worst, and that worst be-

came 18 inches of snow. Never before has a better street-cleaning job been done, and that is saying a great deal, for Mr. Thompson's immediate predecessor had set a mark to shoot at."

Mr. Thompson kept his promise to make Hartford a snow-free city, and, by spreading rock salt at the beginning of each storm gave local residents summer-clear streets in the winter time. During one particularly bad storm, Hartford was the only city in the state where the buses ran, and an official of the Connecticut Company bus operators told Mr. Thompson that his use of rock salt was "the greatest thing that ever happened to the city." Drivers referred to the city limits as "out where the snow begins."

Downtown merchants supported his program. In previous winters their business had fallen off after every storm, for shoppers could not get to the stores. Last year, because main streets were safe and ice-free immediately after the worst storms, stores reported business as usual.

In the case of heavy snowfalls Mr. Thompson found that rock salt kept the snow soft for quick and easy plowing. But generally it was not necessary to plow at all, because the salt melted part of the snow and with the aid of traffic flushed it to the gutters. The small amounts of dilute brine remaining provided insurance that freezing rains and snow of following storms would not bond to the pavement. That meant that snow removal costs were greatly reduced, Mr. Thompson kept a check on the total snowfall and expenditures, and at the end of the season was able to report just how much of the taxpayers' money had been saved. Snow removal costs were 30% under the previous year's for removing an equal quantity of snow.

By giving such facts to the newspapers throughout the winter Mr. Thompson was able to get across to Hartford residents an accurate appreciation of the work his department was doing. The program was so successful that this year he plans to use rock salt again to get his "summer streets" in the winter, and, over the radio and through the news-

papers, he is going to let the people know all about it once more.

New PRA Division Office

A new division office of the Public Roads Administration has been established in the Philippines, with headquarters at Manila, to administer appropriate sections of the Philippine Rehabilitation Act of 1946. The work as defined in the Act will be to "plan, design, restore, and build" such roads, essential streets, and bridges as may be necessary from the standpoint of the national defense and economic rehabilitation and development of the Philippines. A preliminary planning mission has already made extensive studies and has determined that a program to cost about \$100,000,000 will be necessary. Financing will include contributions by both the United States and the Philippines. For the 1947 fiscal year, \$9,960,000 has been allocated by the United States. Francis C. Turner has been appointed division engineer in charge of the new office.

Chicago Decision Upholds Right to Build Property Not Yet Condemned

The building commissioner of Chicago has not the right to refuse a building permit on property soon to be condemned as being in the path of a projected new expressway according to a decision by the city's corporation counsel. But he advised immediate condemnation of the property so that the cost to the city would not be increased. The property in question is in the path of the Northwest Expressway, which has been in the planning stage for a number of years but not determined as to route until passage of an ordinance Oct. 5. The only practicable solution to the problem of preventing such untimely construction, pending condemnation, it was pointed out, is the full cooperation of various branches of city government.

Grease Types and Their Uses

(This information through the courtesy of E. F. Houghton & Co.)

ALTHOUGH a grease is often considered to be no better than the oil with which it is made, much can be said as to the type and quality of the soap. The kind of soap used has an effect upon the physical as well as the chemical characteristics of the product. Other factors which also affect these characteristics are the types of oils used, their physical properties, and the manner in which the oils and soaps are mixed and handled during manufacturing.

At the present time greases are classified according to the types of soap used in their manufacture. The general types of commercially available greases are known as follows:

1. Lime (Calcium) Base Greases
2. Soda (Sodium) Base Greases
3. Aluminum Base Greases
4. Mixed Base Greases
5. Lithium, Barium, Lead, etc., Base Greases.

Through experimentation and field experience certain generalization can be made concerning the use of each type of grease mentioned above.

Lime or Calcium Soap Base Greases

Products of this nature are made from calcium soaps blended with various types and grades of oils. The selection of the base oil is usually dependent upon the final application of the grease. The oils used range from light spindle oils to very heavy, dark cylinder stocks.

Lime base greases are used widely in industry. These greases are highly water-resistant and are usually recommended for applications where moisture is a factor. Greases of this nature are not recommended for the lubrication of equipment operating

consistently at temperatures above 150° F. As lime base greases are emulsions and not true oil-soap solutions, they cannot withstand sustained elevated temperatures without deterioration. Lime base greases are affected by centrifugal action and are therefore not recommended for high speed anti-friction bearings or applications subjected to churning.

Soda or Sodium Soap Base Greases

The manufacture of soda base greases is similar to that of lime soap greases. The same types of oils can also be used. These greases are generally characterized by their fibrous or spongelike texture and can be made to exhibit adhesive as well as cohesive properties. Because of these physical properties and high melting points, they are recommended for applications where high temperatures or high speeds are encountered.

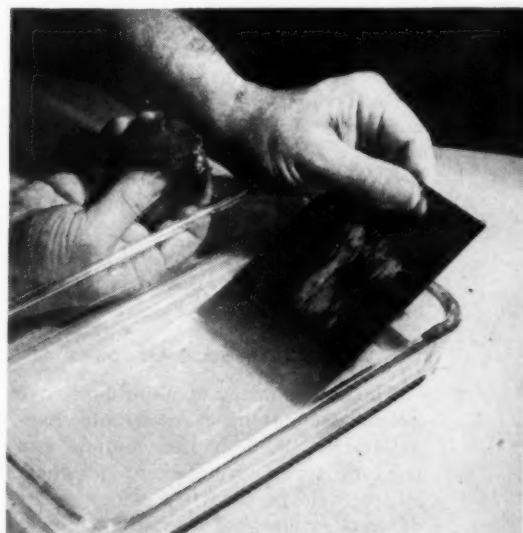
Soda base grease may also be of the "pre-worked" type, smooth and buttery in texture. It is this latter type that is commonly used in ball and roller bearings. Light soda base greases can be used in centralized pressure systems in cases where it is advantageous to stock but one type of grease. However, where practical, aluminum greases are usually recommended for such systems.

Because of the high temperature characteristics of soda base greases, their ability to withstand churning and centrifugal forces, and the fact that they can be furnished with sponge-like texture, they prove to be well adapted to use in small high-speed gear units. Because of the solubility of soda soap in water, these greases are not used generally where moisture is a factor.

Through the use of high quality soaps and oils combined with care-

ful manufacturing practices, these greases can be made so that they are reversible in structure, that is, they regain their original physical charac-

★ Lime base greases do not adhere well to wetted surfaces, but they do resist forming soapy emulsions



★ Soda base greases wet out readily, but are very soluble—and work into soapy emulsions when used in the presence of moisture





★ Aluminum base greases readily adhere to wetted surfaces, displacing moisture—yet do not emulsify as freely as soda base greases

teristics after they have been melted and allowed to cool.

Mixed Base Greases

Mixed base greases have been developed to take advantage of one or more physical or chemical properties of the various soap components. These greases are a combination of two or more soaps and oil. Considerable care is required in the mixing and blending of the different soaps and in the percentages used.

Calcium soap in small percentages is usually added to soda soaps in order to improve the texture of the final product and make it smoother in consistency. Water-resistance as well as adhesive characteristics can be incorporated into a soda base grease by the addition of small percentages of either calcium soap or aluminum soap.

Aluminum Base Greases

The development of aluminum base greases, combining the desirable characteristics of both the sodium and calcium types, resulted in products which could be used in a wider range of applications. They will, in most cases, maintain lubrication at temperatures slightly above the usual accepted range for lime soap greases. The aluminum base greases are soap-oil solution or jels in which the soap is completely and permanently dissolved in the base oil. Their manufacture differs from methods employed in either of the other two greases. Greater care must be taken in controlling the temperatures at the various stages of the manufacturing process. The texture of the final product is governed by the rate of cooling. More expensive and elaborate equipment is required when manufacturing greases of this nature, and not all plants are so equipped.

With the exception of those greases compounded from either dark oils or

steam cylinder stocks, aluminum greases appear to be solidified oils and are quite transparent and brilliant. The use of either aluminum stearate or aluminum oleate in an oil increases the adhesive as well as the cohesive qualities of the product. These greases can be made to form adhesive and tenacious films which are capable of withstanding shock loads at high rubbing speeds without

spattering or wiping off. They are widely used as lubricants for high-speed exposed gears, flexible cables and flat sliding surfaces.

Because of their extreme resistance to decomposition and separation, they are well suited for centralized pressure greasing systems. They do not bleed or separate in service or storage and consequently will not clog feeder lines.

Prevent Shop Accidents with proper care and use of Ladders

These helpful hints from Liberty Mutual Insurance Co.—let's put these ideas to work, get better personal protection and keep the shop running smoothly

LADDERS are found on about every type of construction job. They are involved in injuries to workers in all trades.

It seems a simple thing for a construction worker to be able to go up and down a ladder without falling off—but a lot of workers do fall off ladders and some of them get killed.

Why? For three reasons:

1. The ladder broke.
2. The ladder wasn't set up right and fell over or slid out from under.
3. The employee did not work off or climb the ladder properly.

Design, Construction and Maintenance

Ladders bought commercially are generally well designed and constructed. When they are handled and used properly, they have a long, useful life.

If you are constructing your own ladders on the job, build them soundly. The "ladder specs" in sketch 1 are recommended for 30 foot single ladders.

It is up to you as foremen to see



SKETCH 1

that the ladders used by your gangs are sound, inspected and maintained.

Certain defects, such as broken side rails, missing or broken rungs or treads, are apparent and obviously stamp a ladder as unfit for use. Other conditions that tend to create serious injury hazards may be discovered only upon systematic examination of the ladder. A guide for use in making periodic ladder inspections include:

1. Fractured side rails or missing or broken rungs or treads.



SKETCH 2

2. Rickety ladder. Occasionally a ladder is found with one side rail shorter than the other, throwing the ladder out of plumb.

3. Loose rungs or treads. Be on the lookout for loose rungs or treads that rotate more or less when grabbed or stepped on.

4. Bruises and rot. Watch for signs of mechanical injury, such as bruises caused by dropping the ladder against some hard object.

5. Worn spots. Badly worn spots will require judgment to determine how much wood may be worn away before the ladder is unsafe for further use.

The Safe Use of Ladders

Failure to set up ladders properly is an outstanding factor in ladder accidents.

The safe working angle of a ladder is that obtained when the foot of the ladder is out approximately one quarter the height of the ladder from the base of the vertical support on which it is leaning.

If the angle is steeper, the ladder is apt to swing outwards from the support. If the angle is flatter, the



SKETCH 3

foot of the ladder is apt to slide away at the bottom. The use of only those ladders that fit the job prevents makeshift methods.

And you know it's much easier



SKETCH 4

and safer to get on or off a ladder at a landing when the ladder extends at least three feet above the landing.

Lashings at the top and scabs at the bottom of semi-permanent ladders are important additions to safe, secure ladders.

A sound ladder, set up properly, is still not the whole answer to the ladder accident problem. A large number of ladder accidents are caused by climbing or descending improperly

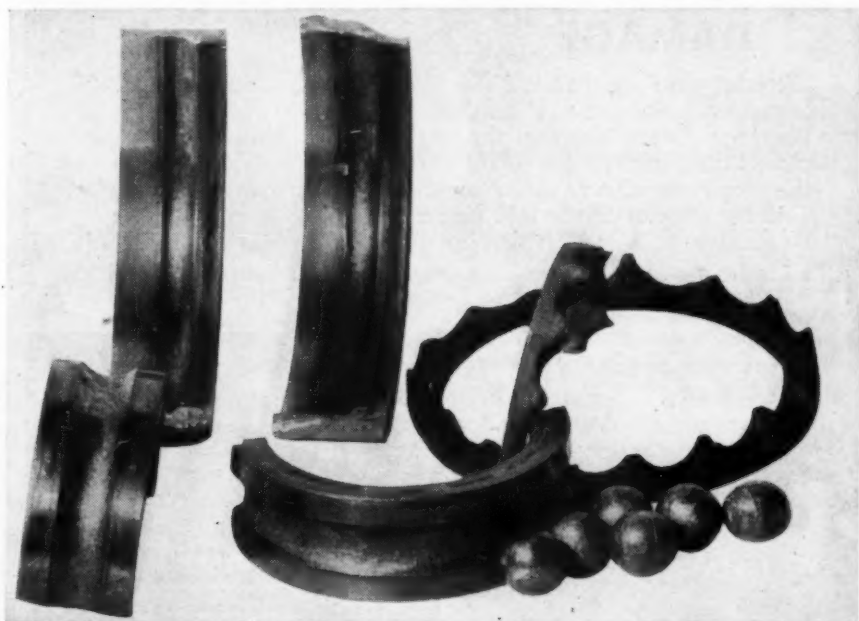
Cause	Accident Number
Climbing or descending improperly	47
Failure to secure ladder at top or bottom....	46
Ladder failure	20
Using wrong type of ladder	15
Setting up ladder improperly	11
Working unsafely on ladders	11

Damage of Ball Bearings by Heat

(From "Ball Bearing Troubles," Marlin-Rockwell Corp.)

Fig. 1—Heat failures occur only at medium and high speed operations. The initial cause is frequently obscured especially at the highest speeds and may be: (1) Failure of lubricant by lubricant source being cut off, lubricant deterioration or contamination; (2) Excessive load; (3) Cramped bearings, either radically tight bearings caused by expansion of inner race when pressing on shaft or expansion of outer race when pressing on housing, or axially tight by squeezing one bearing against another; (4) Off-square producing heat at retainer; (5) Heat from an external source.

Sometimes the initial cause may be diagnosed by noting which parts showed the initial heating, the most heating or by other similar indications.

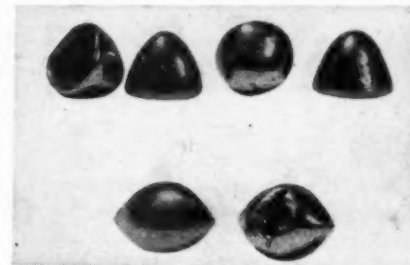


★ Fig. 1



SKETCH 5

Fig. 2—Heat will not only badly oxidize separators but will also soften the balls and races, and particularly the balls because the heat cannot be conducted away from them as rapidly as from the races. Liberal lubrication may make possible continued operation for some time in spite of the partly softened balls and races, and the high centrifugal forces cause the metal to flow. Thus sometimes balls are produced that are hollow, causing the wrong assumption that they were made that way.



★ Fig. 2



SKETCH 6

and working unsafely from ladders.
Falls from ladders frequently oc-

cur because men working from them attempt to reach and cover too large a space from a single setting. Time taken out to move a ladder a little more often will result in more topside work being done and done safely.

Whenever possible, workers climbing ladders should have both hands free. This is often ignored in the interest of "saving time" and workers climb with a handful of tools or materials. Some improvement in safety is possible if a carrying bag is provided. You foremen know the only real answer here, climb the ladder with hands free and hoist tools and materials on a hand line. One of the



SKETCH 7

few exceptions where this method is not practical is a hod carrier.

Look into the use of a scaffold instead of a ladder on overhead jobs where heavy materials, equipment or tools are handled.

Inventory Unimproved Local Roads

Connecticut highway officials are making a complete inventory of unimproved Town roads in the state, as a basis for distribution of certain town aid funds, which under present statutes are allocated on the basis of unimproved road mileages in the respective Towns. In 53 of the state's 169 Towns, 854 miles of such roads were listed, of which 385 miles provided essential service to one or more farm or year-around dwellings. On this basis, only about 40% of the state's 3,235 miles of unimproved roads will be found essential, and these data will be used in considering a fair and equitable allocation of funds to complete the long-range task of getting all farmers out of the mud.

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OTC PUSH-PULLER
removing rear wheel spindle on the Diesel No. 12 Motor Grader by pushing it through bearing. Savings in costly parts, labor and "lay-up" time on jobs soon pay for OTC TOOLS.

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CRITICAL PARTS from DAMAGE

Why let your mechanics take chances with "hammer-and-hope" or "poke-and-pry" methods of removing and replacing bearings, gears, sleeves, sheaves, wheels, shafts and other close-fitting parts? The OTC PULLING SYSTEM provides the proper tools to do these jobs SAFELY, easily and quickly—in the shop or on the job. Approved by Hyatt, M-R-C, New Departure, SKF and Timken for use on their bearings.

No. PE-15 Maintenance Set for track type tractors, Diesel motors, road maintainers, power shovels, drag lines, etc. 2 GRIPOMATIC PULLERS (20 and 9-ton capacities), PUSH-PULLER with extra 22 1/4" and 16 1/2" legs, Pulling Attachments, Heavy Duty BOX WRENCHES and 24" Tubular Handle.

Write for OTC Maintenance Bulletin showing time-saving OTC uses.

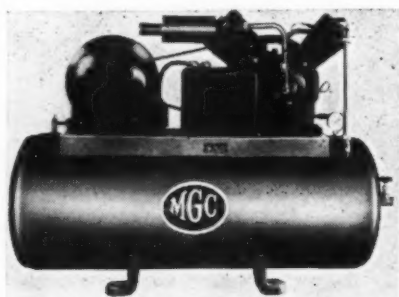
OWATONNA TOOL CO.
319 CEDAR ST., OWATONNA, MINN.

New Construction Equipment and Materials

1.

New Small Air Compressors

Five new models of 2-stage air compressors have been announced by Motor Generator Corporation, a division of The Hobart Brothers Co., Troy, O. These compressors will be available in 7, 9, 13 and 21 cu. ft. capacities and all are furnished with 80 gal. storage tanks, or a 60 gal. tank is optional with the 7 cu. ft. unit.



New MGC Air Compressor

The compressors are of the self contained type with motor and compressor mounted on a one piece steel sub-base which in turn is electrically welded to an 80-gal. horizontal air receiver. They are fully automatic and controlled by centrifugal type unloading valves which guarantee against motor burn-out.

2.

New Hard Facing A.C. Electrode

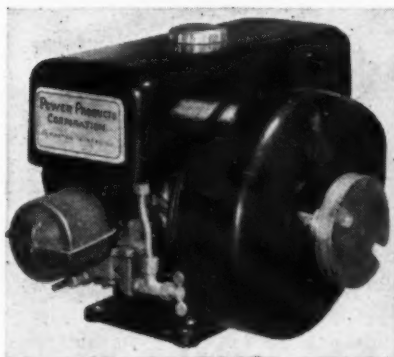
High-carbon electrodes for building up worn steel parts by welding with low voltage A.C. transformers, as well as D. C., have been announced by The Lincoln Electric Co., Cleveland, O. The new electrodes are designated as "Hardweld 50 A.C." and "Hardweld 100 A.C." to differentiate between "Hardweld 50" and "Hardweld 100," which operate only on D.C. The new electrodes,

which have a heavily extruded shielded-arc-type coating, produce flat, smooth beads and the deposits can be hot-forged. "Hardweld 100 A.C." has a hardness of deposit on straight carbon steel when allowed to cool naturally of 20 to 45 Rockwell C. The exact hardness depends upon rate of cooling and carbon content of the steel welded. "Hardweld 50 A.C." on straight carbon steel has a hardness of 20 to 35 Rockwell C.

3.

New Light-Weight Engine

A new light-weight compact gasoline engine, designed particularly for use on portable and self-propelled equipment, has been developed by Power Products Corporation, Grafton, Wis. This 1 hp. engine is 8½ in. by 11 in. by 14½ in. in size and weighs 16 lb. Emphasis has been placed on compact-



New Lightweight Gasoline Engine

ness, so that the engine will take up a minimum of space. Other features

Mail Inserted Card

For data on equipment described on these pages. See also inquiry blank on page 127.

4.

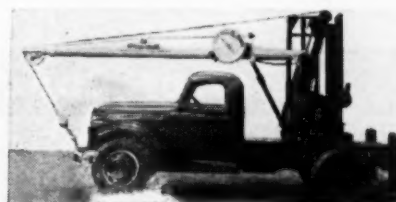
New Electrode

A new electrode stated to greatly simplify the welding of high sulphur, free-machining steel and of certain high tensile, low-alloy steels, has been announced by The Lincoln Electric Co., Cleveland, O. The new electrode, known as "Shield-Arc LH-70," has a low-hydrogen, low-moisture coating and is designed for use with DC polarity, as the welded tensile properties are 70,000-80,000 tensile strength and elongation is 25 to 30 per cent. Welding currents used are high in comparison with other all-position-type electrodes.

5.

New All Hydraulic Truck Crane

A 2-ton crane that employs full hydraulic control for every operation is now in production by Milwaukee Hydraulics Corporation, Milwaukee, Wis. A simple, high capacity hydraulic system operates the entire unit, boom, hoist, swing and even the



Model H-2 2-Ton Hydro Crane

clamshell bucket. The standard tubular boom raises and lowers as well as telescopes from 16 ft. to 22 ft. under hydraulic power. A 360° swing is provided. Ample stability is assured by means of hydraulically powered out-riggers which can be independently extended or retracted both horizontally or vertically in 3 to 5 seconds, from the operator's seat. The Model H-2 mounts on 1½-ton trucks or special 6 x 6 drive Jeeps available at the factory. For clamshell service a standard ¼ yd. bucket, hydraulically powered, is available as well as a hydraulic low headroom bucket for congested quarters.

6.

New Demountable Sand and Gravel Plant

A new, standardized sand and gravel preparation plant, using standard units designed for economical dismantling, reassembling and moving to new locations, has been announced by Link-Belt Co., Chicago, Ill. The plant is stated to provide economical operation for a sizable construction or paving job and removal to new locations, several times a year, by comparatively simple dismantling and reassembly. The equipment includes belt conveyors, scrubber, crusher,

double-deck vibrating screens, sand dewatering screw conveyor, and the necessary power drive units. The stock-piling arrangement can take care of about 6000 tons storage of each size without re-casting. To facilitate moving, the belt conveyors are mounted on steel frames made up in 20-ft. sections, with suitable legs for bolting and unbolting. The scrubber can be lifted from trunnions as a unit with the frame and drive. The trunnions and other units can be similarly removed. All units of the structure are sectional, thus providing means for quick dismantling, and moving, without sacrificing efficiency or capacity.

7.

New Truck Tire

A complete new line of truck tires to be known as the Road Lug, designed and developed by combination off-the-road and highway service, has been announced by The Goodyear Tire & Rubber Co., Akron, O. Production of the Road Lug tire in sizes 7.00-20 through 12.00-24 has begun in Good-



CALCIUM CHLORIDE Stretches Normal Concreting Speed Far into Cold Weather

Hundreds of varied concreting jobs face municipal and highway engineers. For them, cold weather always comes too soon to complete all the curbs and culverts, bridges, patchwork and odd jobs.

Calcium chloride in all concrete

placed at 50° F. or below will work wonders in completing cold weather work on summer schedules. It provides required strength in half the time needed without its use.

Get our booklet, "Early Strength Concrete." It's yours on request.

CALCIUM CHLORIDE ASSOCIATION • LaSalle Bldg., 1028 Connecticut Ave., Washington 6, D.C.

Better Concrete - Faster
with CALCIUM CHLORIDE



The Road Lug

year factories and ultimately sizes 13.00-24 and 14.00-24 will be made available. It is claimed for the Road Lug tire that it is capable of resisting cutting and bruising, providing traction in soggy going and delivering exceptional mileage on improved highways in addition. The tires are constructed with a rayon cord carcass, tread and sidewalls with natural rubber content equal to prewar tires of same size, extra heavy layers of cushion rubber between plies and extra heavy rayon breaker. All sizes

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PERFECTION
BODY *and* HOIST
SERVICE



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GALION, OHIO

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STAKE and DUMP BODIES
HYDRAULIC HOISTS



FOR ANY TRUCK
STANDARD or SPECIAL UNITS
IN ALL SIZES • FOR ANY USE

FOR
LONGER ROPE LIFE—
WICKWIRE SPENCER
WIRE ROPE
—IN ALL SIZES AND
CONSTRUCTIONS
—FOR EVERY NEED.

Constant, careful control through every step of manufacture assures dependable performance, safety and long life in Wickwire Spencer Wire Rope.

**HOW TO PROLONG
ROPE LIFE AND
LESSEN ROPE COSTS . . .**

Thousands of wire rope users—old hands and new—have found "Know Your Ropes" of inestimable value in lengthening life of wire rope. Contains 78 "right and wrong" illustrations, 41 wire rope life savers, 20 diagrams, tables, graphs and charts.



For your **FREE** copy, write
Wire Rope Sales Office, Palmer, Mass.



WICKWIRE SPENCER STEEL DIVISION
The Colorado Fuel and Iron Corporation

THE CALIFORNIA WIRE CLOTH CORPORATION

EASTERN GENERAL SALES OFFICE 891 DELAWARE AVE., BUFFALO 2, N. Y. EXECUTIVE OFFICES DENVER 2, COLORADO WEST COAST OFFICES OAKLAND 4, CALIFORNIA

have multiple beads of high carbon steel wire.

8.

New Blasting Fuse Cap

A new blasting cap that has RDX, the war's most powerful chemical explosive, as its basic charge, has been produced by Western Cartridge Co., East Alton, Ill. RDX, because of tremendous power, is stated to have possibly the smallest blasting cap ever developed. The new cap is hardly



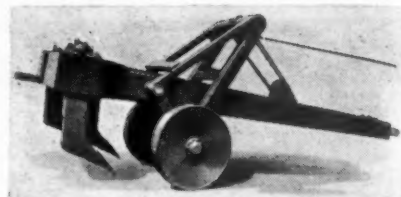
Shows effect of impact of 10 lb. weight on a "Big Inch" cap. The weight was dropped from a height of 4 ft. An untested cap is shown for comparison

more than 1 1/4 in. in length and less than 1/4 in. in diameter. Being made of shining aluminum, the new caps are more easily found when accidentally dropped on dark mine floors. Because the new cap is so short, it is also easier to bury it completely in the smallest stick of dynamite, and reduces the risk of its being struck with a tamping bar. It is stated the new caps are safer to handle and can withstand the shock of heavy impact without detonating. They also are unaffected by temperature changes.

9.

New Cable Operated Rippers

Production of two sizes of cable operated rippers has been announced by Caterpillar Tractor Co., Peoria, Ill. The No. 28 is built for use with one or two D8 tractors; the No. 18 for use with a single D7 or D8 tractor. Both model rippers are equipped with three teeth which are detachable in the event less than that number are required on the job. Replaceable tips of the teeth are of heat-treated alloy. While maximum depths of penetration are 28 in. for the No. 18, and 30 in. for the No. 28, accurate control per-



Model 28 Ripper

mits the operator to rip material to any depth up to the maximum. The rippers are operated by a rear cable control on the tractor. Sheaves are 9 1/4 in. in diameter and 80 ft. of 1/2 in. cable is required for operation. Wheels of the rippers are of steel drum type. Approximate shipping weights of the No. 28 and No. 18 models are 13,000 and 9,500 lb. respectively. Removable cover plates are provided in the frames to permit filling with sand or other materials which will increase the operating weight of each model approximately 2,200 lb.

10.

New Tire for Underground Service

A new pneumatic tire for use on shuttle cars and other equipment used in underground mine service has been

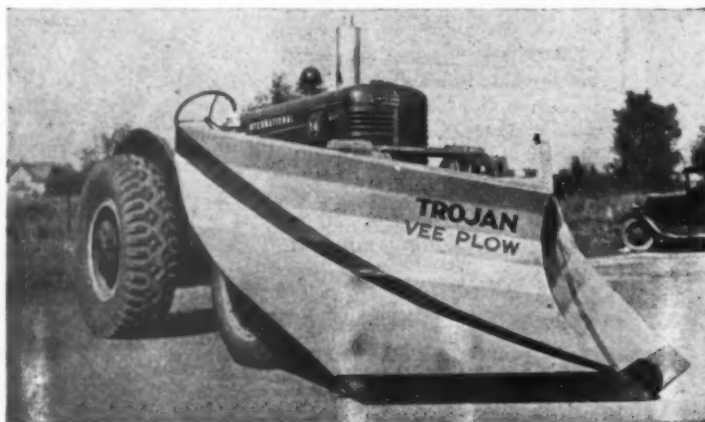
TROJAN



COMBINATION BULLDOZER AND SNOW PLOW

for

International Industrial Wheel Type Tractor



Here is an efficient earth mover which can also be used for snow removal. The bulldozer blade and V type or reversible blade snow plows are interchangeable.

The one control valve provides easy operation and the parallel blade lift and full axle clearance are Trojan features.

This rugged, thrifty tool has been designed for use on International I-4, I-6 and I-9 Wheel Tractors.

Write for literature and specifications or see your International Industrial Distributor.

Contractors Machinery Co., Inc.

Dept. RS 63

Batavia, N. Y.

FLINK SELF FEEDING SPREADER

Faster-Safer-Cab-Controlled!

- Enables you to get icy spots covered faster
- Speed to danger spots, start spreading without stopping truck
- Finish spreading—speed on to next spot without stopping truck
- Operated entirely by driver with clutch control in cab
- Spreads all granular materials up to 1", wet or dry
- Spreads forward or backward—full or half width of street
- Does not limit use of truck—won't interfere with dumping
- Attaches to truck as a tailgate, off in 5 min.

Write for literature or name of distributor near you.

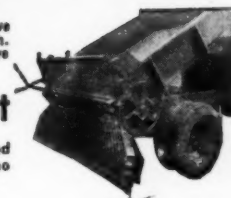
THE FLINK CO.
Dept. 678, Streator, Ill.



Flink Spreader with safety protective housing over spreader blades and clutch. Hydraulic drive and rear wheel chain drive models.

Sand-Chip Attachment

The ideal machine for seal coating, road re-surfacing, dust control. Trouble-free, no working parts to attachment.



Welded Construction
MAKES A BIG DIFFERENCE...

WELLMAN

Williams Type **BUCKETS**

- Wellman leads the field in welded bucket construction. Wellman improved design means better service, lower cost for you! A type for every purpose: Multiple Rope, Power Arm, Dragline, Power Wheel, Special Service: $\frac{3}{8}$ to 16½-yd. capacity.

SEND FOR BULLETIN

THE WELLMAN ENGINEERING COMPANY
7003 CENTRAL AVENUE • CLEVELAND 4, OHIO



Dragline



Multiple Rope



Power Arm

announced by The B. F. Goodrich Co., Akron, O. The tire has been specially designed for the severe demands of mine operation, with round shoulders and extra thick sidewalls to protect it from snagging and cutting. It has 2-way traction, which is essential since shuttle cars operate in both directions. The tire is at present being produced in several sizes including 7.50-15 ten-ply, the most popular size in this service. Maximum load for this tire at 5 miles an hour is 4340 lb., at 10 miles 3880 lb. and 30 miles 2530 lb.

11.

New Power Shovel

The Osgood Co., Marion, O., has announced its Type 81 machine, a modern designed shovel, dragline, clamshell, crane and backhoe of medium size. In addition to three models mounted on crawlers, the Type 81 is also available as an Osgood mobil-crane, the Model 815 self-propelled, one man operated crane mounted on pneumatic tires. The three crawler mounted machines are: the Model 810, of 1½ cu. yd. capacity; the Model 816, of 1¾ cu. yd. capacity, and the Model 817, equipped with wide tread

crawler, and long crane boom for dragline, clamshell or crane service. All models are readily interchangeable from one class of service to another in the field. The Type 81, along with other newly engineered Osgood machines of the larger capacities, has Osgood "Smooth as Steam" air control and the Osgood air-cushion clutch. Power from the engine to the reversing shaft is carried through a roller chain, fully enclosed. The deck is of unit cast steel construction. The ver-



Osgood Type 81 Shovel

tical shafts are splined for clutches and gears, preventing excess wear and replacement. The drum shaft is ball bearing mounted, with skeleton type drums. A swing brake, operated by air is mounted on the lower end of the vertical reversing shaft. The

standard boom hoist operates through the swing and travel clutches, by air, with the final drive for safety of worm and worm wheel, fully enclosed. The shovel boom is all steel, electrically welded box girder type, with an extra wide boom foot. Dipper sticks are double outside type, with manganese steel racking. Shipper shaft is splined for pinion and sprockets. The dragline, clamshell, and crane boom is box type, high strength steel, all welded construction, with tubular lattice. The boom point sheaves are of extra large diameter, and well guarded.

12.

New Portable Compressor

A new Model 60V portable compressor for 1947 has been announced by Davey Compressor Co., Kent, O. This new unit is available in standard skid and 2-wheel pneumatic tired trailer mounting styles, also with flanged wheels for railroad work. It is likewise offered (complete with a Davey heavy duty power take-off) as an "Auto-Air" compressor for truck mounting. The compressor produces 60 c.f.m. at 100 lb. pressure and is designed for heavy duty service. The

*It's
On-the-Job Performance that
Really Counts*



The catalog claims, the salesman's sales talk are quickly proved or disproved "on the job". That's why we ask you to check our statements against the record. Hanson owners and operators everywhere endorse the matter-of-fact statement that "Hanson has the answer to your excavator needs".

Specifications in brief: ¾ or ½ yd. capacity as a shovel - 4½ or 6½ ton lift as a crane - all welded steel construction - Timken Roller Bearings at vital points - bronze bushings at all other points of wear - chain crowd - full reversing - low center of gravity - special Hanson mantling shafts - extra long crawlers - air controlled steering - heavy duty industrial type gasoline or diesel motors - quickly convertible for: CRANE, DRAGLINE, CLAMSHELL, PILE DRIVER, TRENCH-HOE, SHOVEL.

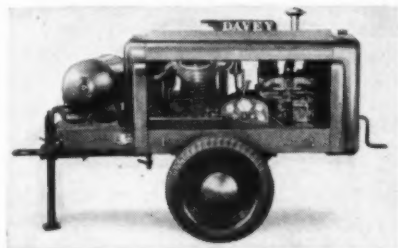
Write for complete specifications and catalog RS-110.

THE HANSON

CLUTCH AND
MACHINERY CO.

TIFFIN, OHIO

compressor has one low pressure cylinder with 5 1/4 in. bore and 4 1/2 in. stroke. The high pressure cylinder has 3 in. bore. Operating speed is



New Davey Portable Compressor

1225 r.p.m. Weight of the 2-wheel model is 2100 lb. Over-all dimensions are: length, 88 in.; width, 62 in. (tire track line, 52 1/2 in.); height, 51 1/2 in. The compressor (in skid, trailer and railway models) is powered by a Hercules IXB engine.

MANUFACTURERS' LITERATURE

13.

Crushing and Screening Plant

The new 46-VE duplex crushing and screening plant with diesel and electric drives is the subject of a booklet issued by Pioneer Engineering Works, Minneapolis, Minn. Fully illustrated, the booklet explains in detail how the plant is constructed, how the simplified drives are arranged, and gives complete specifications. Special emphasis is given to the features which make it possible to secure unusual portability and maneuverability of a high capacity plant. The reduction in weight and savings in mechanical maintenance costs accomplished by electric drive likewise are pointed out.

14.

Wire Rope

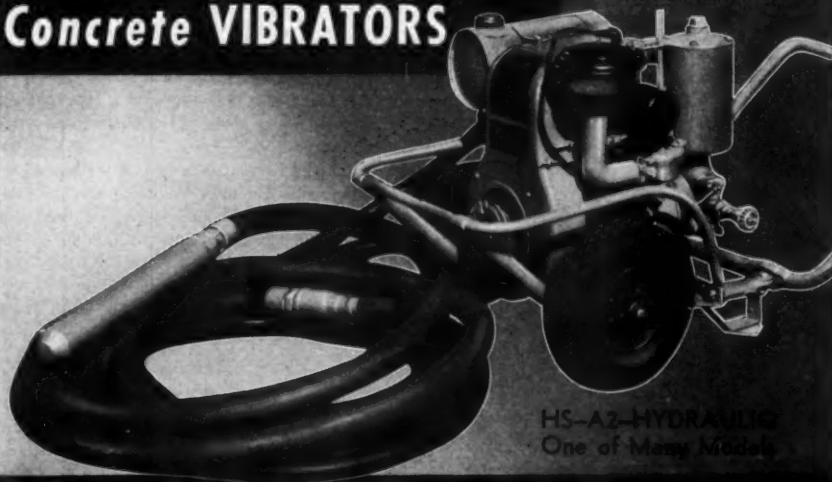
The first of a series of copyrighted informative booklets on wire rope has been announced by Union Wire Rope Corporation, Kansas City, Mo. Free of descriptive advertising, each booklet is designed to serve as a ready reference manual wherever wire rope is used. The first booklet deals with the "Correct Handling of Wire Rope." It discusses such subjects as: Setting up the reel for rewinding; handling coils to be rewound; putting a seizing on a wire rope; sizes of seizing wire; attaching sockets to wire rope.

JACKSON

The LINE That
EXACTLY
Meets Requirements
on **EVERY** Type of Job!

When you buy vibrators, buy JACKSONS! Buy *satisfaction!* The line is as broad as the concrete construction field, with a model to EXACTLY suit the requirements of each and every job. Hence there is never a temptation to sell you an outfit that is less than adequate, or, on the other hand, more than you need. Furthermore, the design and construction of every JACKSON vibrator is founded on more than 25 years of specialization in the development and manufacture of this type of equipment—pretty sound assurance that it will give you the maximum of labor and materials savings and the utmost in dependable, trouble-free service. Consult your JACKSON distributor or write us for the best solution to any concrete vibration problem.

INTERNAL-EXTERNAL
ELECTRIC — FLEXIBLE SHAFT — HYDRAULIC
Concrete VIBRATORS



ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON MICHIGAN

15.

Concrete Maintenance

Concrete maintenance is the subject of the current issue of The Trowel, a bulletin published periodically by The Master Builders Co., Cleveland, O., for men in the construction industry. Discussing the causes of concrete distintegration and how to make successful repairs, this 12-page bulletin contains practical information on the following subjects: bridge maintenance, increasing the useful life by concrete floors by "armorplating," controlling the shrink-

age in machinery grouts, building restoration, repairing hydraulic structures, repairing railroad structures, waterproofing grain elevators and sewage treatment plants, and protective sealing and decorating concrete and masonry surfaces.

16.

Trencher

An 8-page bulletin on the new Parsons 221 Trenchlines has been issued by Parsons Co., Newton, Ia. Special attention is given to photos and information on special working advantages

17.

Steel Flooring for Bridges

Latest engineering information on the design and selection of grating and stringers in accordance with the 1944 AASHTO standard specifications for highway bridges, is given in a 40-page catalog on open steel flooring for bridges. Just issued by Kerlow Steel Flooring Co., Jersey City, N. J., the catalog fully describes the various Kerlow designs and their applications for open flooring and filled slabs, with dimension charts, complete specifications, selection and installation data for each design.

18.

Rubber Products for Contractors

A new pictorial bulletin "Manhattan Rubber Products for Contractors" has been issued by Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J. The bulletin contains interesting installation photographs showing Manhattan belting and hose on important construction projects. A few of these projects made American contractors acclaimed the world over and on which were used equipment designed in collaboration with Manhattan engineers. These are cited with photographs.

19.

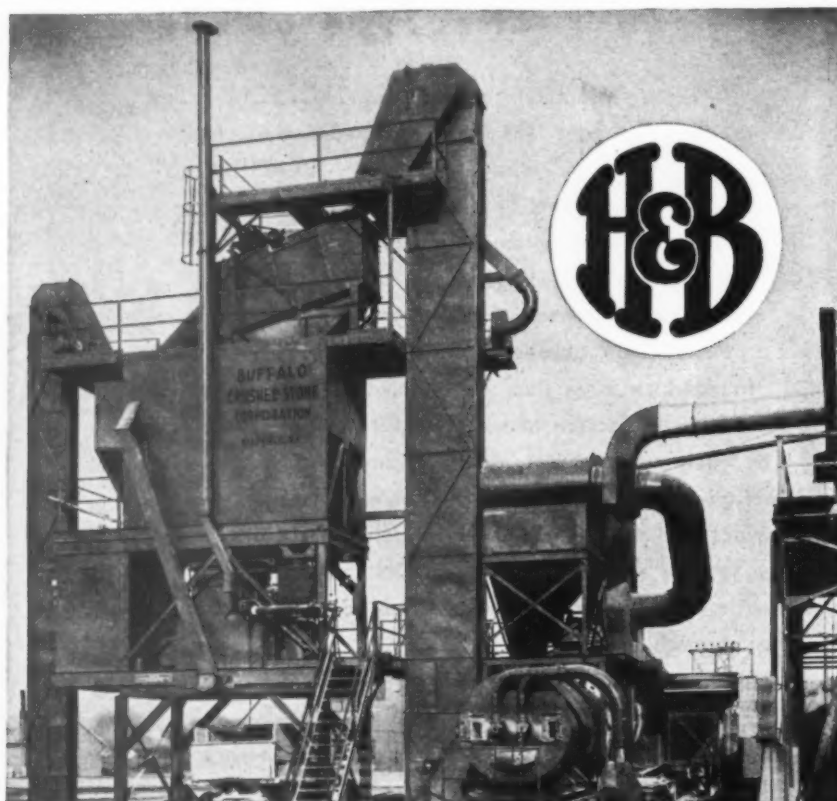
Crushing Equipment

Universal crushing, pulverizing, conveyor, screening and washing equipment is pictured and described in a bulletin just issued by Universal Engineering Corporation, Cedar Rapids, Ia. The 16-page bulletin covers the entire Universal line including portable plants and basic units, and pictures typical installations together with flow of material diagrams.

20.

Weekly Wall Calendar

The 1947 calendar of the Frederic Post Co., Chicago, Ill., will be ready for distribution early in December. This is a 12 in. by 20 in. spiral bound calendar catalog with engineering data and full 12 months on the back.



"GREATLY PLEASED WITH THE RESULTS OBTAINED"



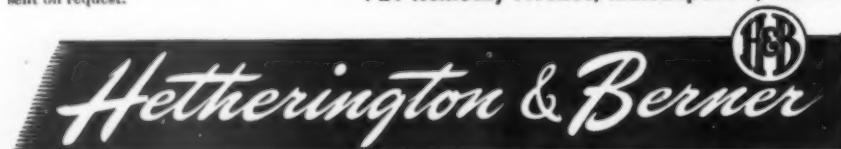
THE MOTOPAVER

The new self-contained, self-propelled complete traveling mixer and paver. Mixes, spreads and lays any medium or low-cost type bituminous material—to any road width, thickness, crown. Bulletin MP-46 sent on request.

★ The H & B Portable Asphalt Plant shown above was delivered and put in operation last spring. Mr. F. W. Schmidt, president of the Buffalo Crushed Stone Co., owners, says: "After three months operation we want to tell you how greatly pleased we are with the results obtained. We are particularly impressed with the ease and economy of operation of the fluidometer and automatic mixing cycle. The product of this plant has met with very favorable acceptance from our customers."

H & B Portable and Stationary Asphalt Plants are available in a wide range of capacities. Write for literature.

HETHERINGTON & BERNER INC.
721 Kentucky Avenue, Indianapolis 7, Indiana



In addition to the vivid 5 color inspirational theme of the top is the week by week—52 pages of the large size daily date numerals—52 weekly pages featuring standard items like tracing paper, ruling pens, drafting machines and furniture, plus the introduction of new drafting room merchandise ready for 1947.

21.

Rock Salt Application Methods

The International Salt Co., Inc., Scranton, Pa., has published a new booklet titled "Snow and Ice Removal on Highways, Streets & Airport Runways" for the use of street and highway maintenance departments. The pamphlet outlines recommended application procedures for using rock salt to do a speedy, complete job of ice and snow removal at low cost. To cut down the winter accident toll, the booklet tells how safe driving surfaces may be obtained by keeping winter traffic arteries free of dangerous snow and ice.

**WITH THE
MANUFACTURERS
& DISTRIBUTORS**

To Head S.A.E.

C. E. Frudden, consulting engineer of the Allis-Chalmers Mfg. Co., Tractor Division, is the sole nominee for the 1947 national presidency of the Society of Automotive Engineers.



C. E. Frudden

The nomination is tantamount to election. He will be the first Wisconsin man and the first tractor man elected to the presidency of the 40 year old society. He will take office at the end of January. Mr. Frudden joined the Allis-Chalmers tractor organization in 1929, where he has been instrumental in effecting many of the remarkable advances apparent in the tractor field during the past 17 years. Shortly before the war he was promoted from chief engineer of the West Allis Tractor Division to executive engineer of the entire Allis-Chalmers Tractor Division.

New District Representative

James M. Borror has been appointed Northwest District Representative of The Galion Iron Works & Mfg. Co., Galion, O., covering the states of Washington, Oregon, Idaho, Montana, and Wyoming. Mr. Borror is a licensed civil engineer and surveyor, graduating from Ohio State in 1937. Had 4½ years practical experience before entering the Army where he served 51 months in the Engineers Corps—rank of Captain. Army service included 2½ years training heavy equipment operators.

Richkraft Takes Over Silvercote Sales

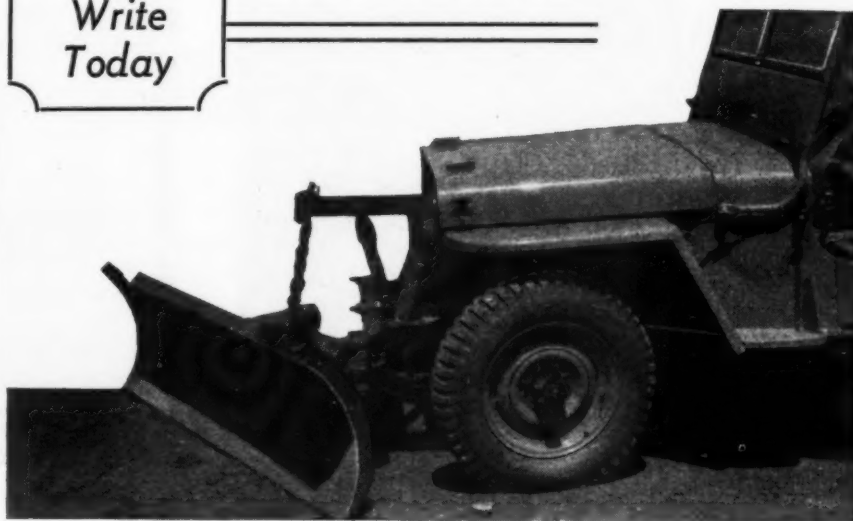
The Silvercote Products Co., Chicago, Ill., has appointed The Richkraft Co., Chicago, Ill., as sole distributor of Silvercote reflective insulation papers in the building and construction fields. Distribution of Silvercote insulation will be handled through The Richkraft Co.'s national sales organization as a companion product with Richkraft building papers, Richkure concrete curing compounds, and Richlume waterproof, insulating roof coating.

Schenker JEEP SNOW PLOW and BULLDOZER

Prompt
Delivery

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Wire or
Write
Today

A year-round tool. Snow-removal in the winter. Terracing, grading and back filling other seasons. Well built with hydraulic lift. 5' or 6' blade. Easily mounted. Weight 380 lbs. Blade 24" high. Blade position to 5 angles, with extreme position 28 degrees. Already in use by contractors, municipalities, county highway departments, etc. Write today for complete information.



GLENN M. ROGERS, INC.

Ellicott Square Bldg.

Buffalo 3, N. Y.

Phone: Washington 6642

Harry C. Ehrick Is Dead

Harry C. Ehrick, chief engineer of the Huber Manufacturing Co., Marion, O., died recently of a heart ailment. He was born in Bucyrus, O., March 22, 1887, and joined the Huber company staff in the early thirties, serving at first as production engineer. In 1939 he left Huber and went to the Buckeye Traction Ditcher Co., at Findlay, as the works manager, a post he held until his return to Huber, June, 1944. Earlier in his career, Mr. Ehrick was connected with the Hadfield-Penfield Steel Co., an English firm who maintained branches in Bucyrus and Mansfield, O., during World War I. After that war was over, his company sent him to Europe on behalf of the (English) government—a confidential mission in regard to studying a secret process for the manufacture of armor piercing projectiles.



H. C. Ehrick

New Sales Office for Heil

A new district sales office has been established by The Heil Co., Milwaukee, Wis., in the Candler Bldg., Atlanta, Ga., under the direction of Jack Davies, District Manager. This is one of seven Heil field offices being maintained throughout the United States. The Atlanta office will service Heil distributors in the states of North and South Carolina, Georgia, Florida, Alabama, and part of Tennessee. Davies will handle sales of Heil road machinery, bottle washers, heating and water systems, and dehydrators. Alec Milne, former national accounts representative at Detroit, has been transferred to Atlanta and will concentrate on sales of Heil bodies and hoists and tanks. Both Davies and Milne have seen overseas duty in the army.

Schraub Elected Director

L. G. Schraub, Vice-President and General Manager, has been elected to the board of directors of Union Wire Rope Corporation, 21st and Manchester, Kansas City, Mo.

New Canadian Sales Agents for Lima

Lima Locomotive Works, Inc., Shovel and Crane Division, Lima, O., has appointed the following Canadian sales agents for Lima shovels, cranes and draglines: Armco Drainage & Metal Products of Canada, Ltd., Winnipeg, Man. Territory: Manitoba, Saskatchewan. Equipment Sales & Service, Ltd., 464 Queen St., East Toronto, Ont. Territory: Ontario. Automotive Products Co., 3282 Wellington St., Montreal, Que. Territory: Quebec. Dietrich-Collins Equipment, Ltd., 890 S.W. Marine Drive, Vancouver, B. C. Territory: British Columbia.

New Davey Distributor

Contractors Machinery Co., Inc., Kansas City, Mo., has been appointed distributor for Davey Compressor Co., Kent, O. Territory covered includes: counties of Mercer, Grundy, Livingston, Carroll, Saline, Pettis, Morgan, Camden, Laclede, Wright, Douglas and Ozark; west to the eastern borders of Oklahoma, Kansas and Nebraska.

For FAST, PRECISION
**HEAVY-DUTY
CRANE WORK**
MICHIGAN
MODEL TLDT-20

Mobile
CRANE

12 TON
CAPACITY

FINGER TIP
AIR CONTROLS

MICHIGAN
POWER SHOVEL CO.
BENTON HARBOR, MICHIGAN



ETNYRE
"Black-Topper"
BITUMINOUS DISTRIBUTORS



Accurate distribution, Dependable performance
Minimize maintenance, save time, reduce labor costs by accurately covering roads up to 24 feet wide in one trip with a dependable Etnyre "Black-Topper." See your Etnyre dealer or write us today for complete details.

E. D. ETNYRE & CO., Oregon, Illinois

Appointed Advertising Director

Miss Bobette Crane has been appointed director of advertising of R. B. Rogers Companies, Inc., New York, N. Y. She will be in charge of all advertising for the company as well as for its affiliates, which include Indian Motorcycle Co. and Ideal Power Lawn Mower Co., Springfield, Mass., Hill Diesel Engine Co., Lansing, Mich., Edwards Co., Sanford, N. C., Rogers International Corporation, New York, and others. She joined the Rogers advertising department four years ago, and was previously with the Export Advertising Association. She is a graduate of Hunter College. Miss Crane will make her headquarters at the R. B. Rogers Companies, Inc., offices in New York.



Bobette Crane

Named General Sales Manager

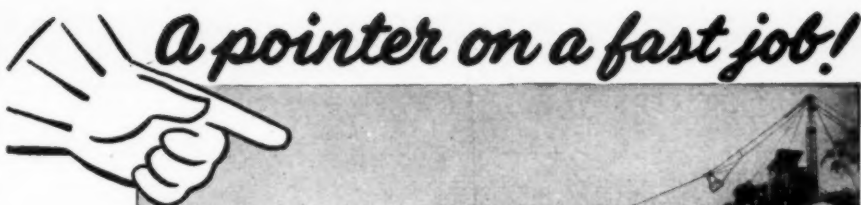
Hugh A. Cameron has been appointed general sales manager for Beckwith Machinery Co., Pittsburgh, Pa. In charge of all unit equipment sales of road and construction machinery at Pittsburgh, Mr. Cameron will also supervise sales at branch offices at Bradford, Wilkes-Barre and Harrisburg. Mr. Cameron, who has been with the Beckwith Co. for 25 years, previously branch manager of the Wilkes-Barre office but will now make his headquarters in Pittsburgh.



H. A. Cameron

Calcium Chloride Assn. Moves to Washington

The Calcium Chloride Association has moved its offices from the Penobscot Bldg., Detroit, Mich., to the La Salle Bldg., 1028 Connecticut Ave., N.W., Washington 60, D. C. The move has been under consideration for some time, and Washington was selected because of facilities offered for engineering and technical reference in the fields in which calcium chloride is used. The Association was formed in 1933 by the Dow Chemical Co., Pittsburgh Plate Glass Co., Sol-



Sauerman Slackline Cableway with tail anchorage nearly 1500 ft. away from mast, scoops gravel from bar in bend of river and hauls over 100 tons an hour to plant.

→ with Sauerman Long Range POWER SCRAPERS and SLACKLINE CABLEWAYS

→ You need only the labor of one man and the SAUERMAN machine to do a long haul job of material moving . . . and do it easily, rapidly and economically. All over the world SAUERMAN Long Range machines are solving difficult dig-and-haul problems and making savings over estimated costs. Installation is simple. Power and maintenance items are small.

Let Our Engineering Department Advise You

There is a type of SAUERMAN Machine to meet your specific problem. For digging in wet or dry ground, from pond, river or pit; also for picking up and moving all kinds of materials, and handling stockpiles. Operation by either electric, gasoline or Diesel power. From long experience we will be glad to recommend suitable equipment for your job. Catalog showing typical installations will be sent on request.

→ SAUERMAN BROS., INC.

588 S. Clinton St.

Chicago 7, Illinois



MOTOR
DRIVEN
SAND
and
CINDER
SPREADER

Sold and distributed by leading Construction and Machinery Dealers throughout the United States and Foreign Countries.

THE HIGHWAY MODEL DD

The Highway Model DD Spreader permits one man to cast a uniform swath of sand or cinders 8 to 60 feet wide at truck speeds up to 35 miles per hour. Clamps onto tail gate of any standard dump truck. Simple adjustment keeps spreader in horizontal position to cast material under and ahead of rear truck wheels. Truck can travel ahead of traffic with safety. Material is fed into hopper by gravity — no shoveling required. Adjustable feed gates control thickness and direction of spread. Throttle on 1½ H.P. Briggs and Stratton gasoline motor determines width of spread. Widely used for ice control in winter, the Highway Model DD is ideal for seal coat work and dust control in summer.

Write for descriptive literature.

HIGHWAY EQUIPMENT COMPANY

605 D Avenue N.W., Cedar Rapids, Iowa

MANUFACTURERS OF THE WORLD'S MOST COMPLETE LINE OF SPREADERS

ROGERS TRAILERS EMBODY THESE 3 ESSENTIALS



EXPERIENCE
builds 'em...

ROGERS BROTHERS CORPORATION
110 ORCHARD ST. • ALBION, PA.

PERFORMANCE
sells 'em...

LOADABILITY —

Fast, comparatively easy loading due to extremely low height of deck.

HAULABILITY —

Light but strong construction permits fast travel at less cost.

BRAKEABILITY —

Air or vacuum brakes capable of sure, safe stops under all conditions are available.

vay Sales Corporation, and the Wyandotte Chemicals Corporation for research and the distribution of information on the uses of calcium chloride. The association offices have been maintained continuously in Detroit until the present. Managing Director George H. Kimber and engineering editorial staffs moved to the new headquarters the latter part of September and have resumed the association program.

B. P. Span Promoted

B. P. Span, formerly advertising manager Gardner-Denver Co., Quincy, Ill., has been promoted to personnel and industrial relations director. Mr. Span, who has been with the Gardner-Denver Co. since 1934, with the exception of 38 months in the Navy, where he attained the rank of Lieutenant Commander, will be in charge of all factory and office personnel for the company's Quincy plant. The new Gardner-Denver Advertising Manager is D. P. Tunnicliff. Mr. Tunnicliff was graduated from the University of Illinois in 1943 with a B. S. degree in journalism (advertising). He was formerly employed by the Quincy Herald-Whig in an editorial capacity, after having served 3 years of active duty in the Navy.

New Advertising Manager

Gilmore Hiatt has been appointed advertising and sales promotion manager for Gorman-Rupp Co., Mansfield, O. Mr. Hiatt resigned his position as advertising manager for refrigerators and home freezers with the Westinghouse Electric Corporation to accept the new appointment. He is a former newspaper man and was advertising manager of the Mansfield News-Journal and the Marion (O.) Star. He will direct all of the advertising activities in marketing Gorman-Rupp pumps nationally and in foreign countries.



Gilmore Hiatt

regional office places C.I.T. in a position to provide complete, on-the-spot industrial financing service for their growing list of southern clients. Another link is thus added to their coast-to-coast chain and the extensive facilities of C.I.T. are again made more readily available over a steadily increasing area to a large number of up-and-coming concerns as well as those industries who enjoy established reputations. In line with the policy of the company, modern financing services will be provided specially designed to expedite the purchase and sale of construction equipment of all types. In addition, capital will be made available for a wide variety of business purposes.

International Truck Personnel Changes

International Harvester Co. has announced the following changes in motor truck personnel: E. A. Razek, formerly retail motor truck manager at the Richmond motor truck branch, has been transferred to the Atlanta motor truck branch as assistant manager. B. G. Jones, formerly credit manager at Louisville, has been appointed assistant manager, Louisville motor truck branch.

C.I.T. Opens Atlanta Office

C.I.T. Corporation, New York, N. Y., specialists in industrial financing, has opened a regional office at 223 Peachtree St., N.E., Atlanta, Ga., under the management of Edward H. Mayer, Assistant Vice-President. The opening of this centrally located

TOPS with the BIG TOP

For over 8 years La Crosse Trailers have been in constant use with the Ringling Bros. and Barnum & Bailey Circus—answering the call for any job, in any weather, on any terrain throughout the 48 states—passing the toughest of tests with top performance—supplementing the work of elephants, horses and manpower aboard the biggest railroad show in the world.



LA CROSSE
TRAILER CORPORATION

LA CROSSE,
WISCONSIN
U. S. A.

On most jobs When Excavating is Necessary

The OWEN BUCKET Co.

6070 Breakwater Avenue Cleveland, Ohio

Branches: New York Philadelphia Chicago Berkeley, Cal.



You'll most likely come face to face with one or more Owen buckets, should your travels take you to an excavating job.

The reason why is most simple, for consistent superior bucket performance by Owens is responsible for their widespread use and acceptance.

Bring your equipment catalog files up to date NOW by requesting your copy of the latest Owen Catalog.



Abbey Appointed District Representative

John M. Abbey has been appointed district representative of the central sales division of Caterpillar Tractor Co., Peoria, Ill. He will contact the following "Caterpillar" dealers in New Mexico and western Texas: R. B. George Company at Amarillo and Lubbock, Tri-State Equipment Co. at El Paso and Odessa, and R. L. Harrison Co. at Albuquerque. Mr. Abbey became associated with "Caterpillar" as a member of the accounting department in 1936. He later served in the treasury and engine sales departments, entering sales training division last April.



J. M. Abbey

Amsco Appointments

The American Manganese Steel Division of American Brake Shoe Co., Chicago Heights, Ill., has announced three major appointments: A. R. Sittig as manager of manganese steel sales, with offices at Chicago Heights, Ill.; E. L. Quinn as assistant vice-president in charge of welding products, with offices at Chicago Heights, Ill.; and E. J. Nist as assistant vice-president with offices at 230 Park Ave., New York, N. Y. These veterans of many years with Amsco, are well-known in the field having long been associated with the selling of manganese steel parts and welding products.

Returns to Borg-Warner

G. A. Shallberg, Jr., has returned to Borg-Warner Corp. as advertising manager. Recently discharged from the U. S. Army after 18 months of service, Mr. Shallberg served with the Special Investigation Detachment of the Counter Intelligence Corps in the American zone of occupation in Europe. In his new position he will be directly responsible for the company's advertising.

Becomes Service Manager for Patten

Harold L. McCormack who has been associated with Caterpillar Tractor Co. at its Peoria, Ill., offices as service claims manager, has left the company to become service manager for Patten Tractor & Equipment Co., 620 South 25th Ave., Bellwood, Ill., the company's distributor for that area. Mr. McCormack joined "Caterpillar" in 1936, spending a year in the factory on special engine assembly and later being associated with the service department. He served 4½ years in service engineering and two years in service training. During the war he played an important part in conducting the Army classes at "Caterpillar" and then served two years as service representative in the middle western states. He returned to specialize in tool development until May 1 of this year when he was named service claims manager.



H. L. McCormack

New Davey Distributor

Claude B. Smith Co., 615 Sansome St., San Francisco, Calif., has been appointed distributor of Davey compressors for Northern California.

ONLY JAHN TRAILERS GIVE YOU ALL THESE FEATURES

- 1 Improved, fabricated gooseneck with its greater built-in strength.
- 2 Positive, equalized braking at each wheel regardless of position of axle.
- 3 Deep wide flange main beams run the full length of the trailer.

- 4 Worm gear type slack adjusters at each wheel.
- 5 Constant lift cam provides improved brake application.
- 6 Exclusive axle designs furnish ample oscillation for equal load distribution on all tires.



C. R. JAHN COMPANY

1345 WEST 37th PLACE, CHICAGO 9, ILLINOIS

get all the details from your nearest Jahn distributor

RAPID!



Cuts concrete and cuts labor costs to 2 1/2 c per square yard. Applicable to floor work and different types of inside horizontal work.

Very efficient in maintenance work of highways.

Boom folds down and readily trailed by any light truck. Make your compressor treble its output by hooking it to this machine.

Rapid Pavement Breaker Co.

1517 Santa Fe Ave.
Los Angeles 21, Calif.

VULCAN PAVEMENT AND CLAY DICING TOOLS

ARE MADE in a complete line of sizes to fit all standard compressed air hammers.

Send for NEW Vulcan Illustrated CATALOG today.

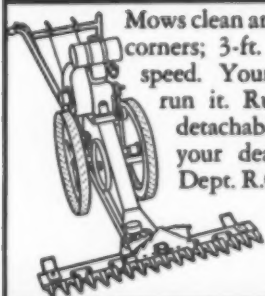


TOOLS — THE WORLD OVER —
NOTED FOR QUALITY AND DURABILITY

VULCAN TOOL MFG. CO.
QUINCY, ILL.

CUNNINGHAM

MOWER



Mows clean and fast in tight corners; 3-ft. cut; variable speed. Young folks can run it. Rugged design, detachable engine. See your dealer or write Dept. R.O.

Fence Rows
Roadsides
Railroads
Farm Lawns

JAMES CUNNINGHAM, SON & CO.
13 Canal Street, Rochester 8, N. Y. Est. 1838

Named Assistant Sales Manager

K. V. (Ken) Turner has been appointed assistant sales manager of the LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Ia. He started work for LaPlant-Choate as a blueprint clerk in the Engineering Department in 1938. Since then his experience with this company has included service work, export sales, coordination between the Federal Government, sales and production; government sales, field engineering research, and district sales representative in northeastern United States. Last year he was called back to the Cedar Rapids office to assist in organizing LaPlant-Choate's independent dealer program. His recent promotion is a result of outstanding work in connection with this program which will be complete with the appointment of more domestic dealers.



K. V. Turner

FWD Personnel Changes

The Four Wheel Drive Auto Co., Clintonville, Wis., has announced the appointment of new representatives in several middle western states, and the transfer of representatives between these states. Lower Michigan and the state of Indiana will be under the supervision of Oscar Dolberg, district sales supervisor. Mr. Dolberg formerly covered the territory consisting of Ohio and Kentucky. The Ohio-Kentucky territory will be under the supervision of Elmer Porter, former representative in Illinois. John Youngs, who formerly supervised the lower Michigan, Indiana territory, was transferred to upper Michigan.

Victor Anderson, assisted by Francis Thompson will be in charge of the southern part of Illinois and Harry Ringdahl, former specialty salesman in Wisconsin, will handle the metropolitan Chicago area. The states of Missouri and Kansas have been assigned to C. E. Balun, formerly administrative assistant to Mr. Engel in the mid-western FWD zone office at Appleton.

Jeffries Appointed District Representative

R. E. Jeffries, a member of the Caterpillar Tractor Co. organization for 12 years, has been appointed district representative for the eastern sales division. He will contact three "Caterpillar" distributors, Michigan Tractor and Machinery Co. of Detroit, Ohio Machinery Co. of Cleveland and West Virginia Tractor & Equipment Co. of Charleston. Mr. Jeffries joined the company's parts department in 1934. He later became associated with "Caterpillar's" governmental sales division, serving in both Peoria and Washington, D. C., offices. For the past three years he has been a member of the war contracts division.



R. E. Jeffries

Fitzpatrick Appointed Factory Agent

The Allied Steel Products, Inc., 7835 Broadway, Cleveland, O., announced the appointment of John G. Fitzpatrick, 208 Buckingham Drive, Indianapolis, Ind., as direct factory agent in the territory consisting of Ohio, Indiana, Illinois and Michigan.

PORTABLE ASPHALT PLANTS

High Production—Low Cost



THE McCARTER IRON WORKS, INC.
NORRISTOWN, PENNA.

Reliance

CRUSHING, SCREENING
and WASHING UNITS

● Up to 2000 Tons a Day ●

Crushers	Bins	Drag-Lines
Elevators	Pulverizers	"GAYCO"
Sweepers	Feeders	Centrifugal
Screens	Spreaders	Air Separators
Wash Boxes	Kettles	
	Conveyors	

UNIVERSAL ROAD MACHINERY CO.
Kingston, N. Y.

Canadian Representatives: F. H. Hopkins & Co., Ltd.
340 Canada Cement Co., Montreal, Que., Can.

CONTRACTORS RUBBER PRODUCTS

available from Stock
for immediate Delivery

CONVEYOR, ELEVATOR and
TRANSMISSION BELTING
all widths and plies

V-BELTS all sizes

HOSE

all sizes and types

AIR	DISCHARGE	STEAM
FUEL	COMPRESSOR	VACUUM
FIRE	PILE DRIVERS	SUCTION
WATER	ROAD BUILDERS	WELDING

BOOTS, DREDGE SLEEVES,
PUMP DIAPHRAGMS, ETC.

... and everything rubber
for Industrial Requirements

Write for new catalog

PHONE WRITE WIRE
CARLYLE RUBBER
CO., Inc.

62-66 PARK PLACE - NEW YORK 7
Phone Barclay 7-7733

Named Assistant to Gar Wood Chairman

Thomas A. De Marco, formerly with United Aircraft Products Corporation, has been named executive assistant to John J. Bergen, chairman of the board of Gar Wood Industries, Inc., with head-



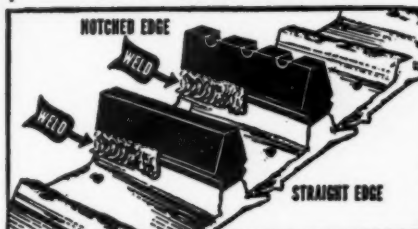
T. A. De Marco

quarters in New York. Mr. De Marco served as an Air Corps Major in the office of the Assistant Chief of Air Staff, Washington, D. C. Prior to entering the Air Force, he was with the Chapman Valve Manufacturing Co., Springfield, Mass., and then became western New England sales engineer for Johns-Manville Sales Corporation.

New Logan Distributor

Patterson Sales Co., El Paso, Tex., engineering sales representative for machinery and industrial equipment, has been appointed distributor of the aridifier in Arizona, New Mexico, Mexico and Central America by Logan Engineering Co., 4900 Lawrence Ave., Chicago, Ill.

Rebuild your
TRACTOR GROUSERS
WITH **BULLDOG**
Grip-Lugs



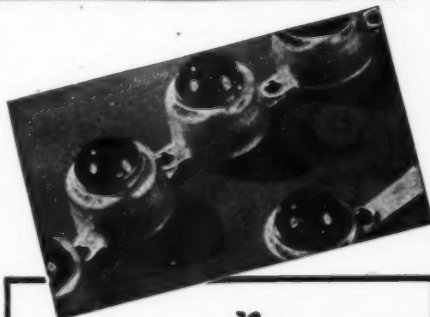
Easily Welded

**ECONOMICAL
GIVES MORE
PULLING POWER**

See your local
Equipment Dealer

Send for Folder RS

ALLIED STEEL PRODUCTS, Inc.
7835 Broadway
CLEVELAND 5, OHIO, U. S. A.



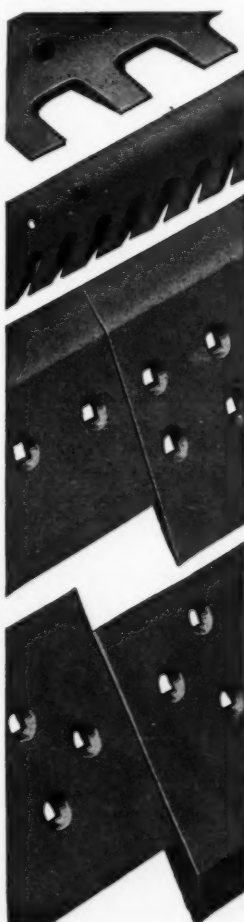
Permanent

BRIGHT SIGNS

**for DETOUR SIGNS
and BARRICADES**

● Detour Signs easily made with Cataphote Chain Reflectors can be used over and over again. No loss of reflection. Also wood mounted buttons for wooden temporary signs. Low cost. Send 25c for samples. Cataphote Corp., Toledo, Ohio.

**CATAPHOTE
REFLECTOR CHAINS**



Shunk GRADER AND SCARIFIER BLADES

For any type or make of machine—Motor Graders, Maintainers, Scrapers, Drags, Bulldozers, Backfillers, Wagon Scrapers, Trail Builders, Trail Blazers, Carryalls, Snow Plows. Also—CUTTING EDGES, WEARING BOOTS, BACK SLOPERS, EXTENSION BLADES, MOLDBOARDS and SCARIFIER TEETH

50 years of specializing in the manufacture of Construction Equipment Blades has developed for your benefit a quality of special steel, milled through our own rolls and forged at the edges to give that extra cutting and wearing quality you need.

Furnished in various widths, lengths, and thicknesses, punched ready to fit your machine.

Consult your internationally recognized Blade Specialists. Write for special bulletins, giving type and name of machines you operate—get set for Blades early.

Shunk
**MANUFACTURING
COMPANY**
Established 1854
BUCYRUS, OHIO



CLEARING HOUSE

FOR SALE CLIMAX GASOLINE ENGINES

NEW — model V-425, 12 cylinder 425 H.P. at 1200 RPM, gasoline engine power unit complete radiator to twin disc clutch inclusive with gasoline starting engine. Cheaply convertible to natural gas operation. Priced far below factory list, 7 units available. Dealers invited.

THE FINN EQUIPMENT COMPANY

2525 Duck Creek Road
Cincinnati 8, Ohio
Phone East 1125

WANT TO BUY
2 — 25 to 50-TON CAP.
PORTABLE CRUSHING
PLANTS COMPLETE —
GAS OR DIESEL.

THE DARIEN CORP.

DARIEN

CONN.

RARE DECORATION

STEER HORNS For Sale over SIX FOOT spread. Polished and mounted. Fine decoration for home or office. Rare opportunity, Texas Longhorn cattle now extinct. Free Photo. Lee Bertillon, Palestine, Texas.

FOR SALE

- 1—Foote Paver\$3,000.00
- 1—Huber Roller, Gas, 10-ton
—3-wheel 1,250.00
- 3—Steam Tandem Rollers (Prices vary)
- 1—Barber-Greene Ditcher ... 2,500.00
- 2—Drott Universal Bull Clam
Shovels (New), each 500.00
- 1—Buckeye Sub Grader, 10'
to 12' 3,250.00
- 1—Iroquois Asphalt Plant
2,000 lb. box15,000.00

PHIL H. McQUIRE

P. O. Box 34, Norfolk, Va.

QUALITY

OVERHAULED EQUIPMENT

All equipment listed is owned by us, and has been overhauled in our daylite shop by experienced mechanics.

PAVING EQUIPMENT

Ransome Paver, Dual-Drum Buckeye Finegraders. For ½ and full width pavement
Jaeger Spreaders
Jaeger Finishers, Model H, full and ½ width pavement
Blaw-Knox Finishers, ½ width pavement

BUCKETS

Owen & Blaw-Knox. 1½, 1¾, 2½ and 3 yd. rehandling.

FORMGRADERS

Cleveland "Car". With Waukesha Motors.

FORM TAMPERS

Jaeger (new).

PULVI-MIXERS

Seaman. With power.

ROOTERS

Isaacson & Davenport. Various Sizes.

BOEHCK EQUIPMENT COMPANY

2404 West Clybourn Street
MILWAUKEE 3, WISCONSIN

WANTED

Used and in A-1 Condition,
Complete Pile Driving
Equipment

RUSCIANO & SON CORP.

728 East 212th Street
New York 67, New York

AVAILABLE — IMMEDIATELY

New Cedarapids two unit mobile crushing, screening and loading plant. Will consider lease or sale on yardage basis anywhere.

JOHN T. MOUSER,

c/o Construction Materials Co.
306 Hamilton Street, Peoria 2, Illinois

Try a **Pierce-Bear** on that tough job!

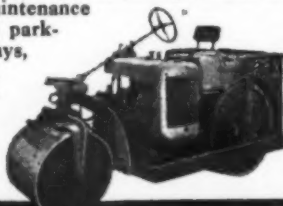


3½ TON — VARIABLE WEIGHTS

Engineered refinements and rugged strength have earned for these rollers enviable performance records. Compact design gives efficient operation in close quarters. Ideal for maintenance work on highways, airports and parking areas. Fine for driveways, docks, etc. Easy to operate. They do a good job at low cost.

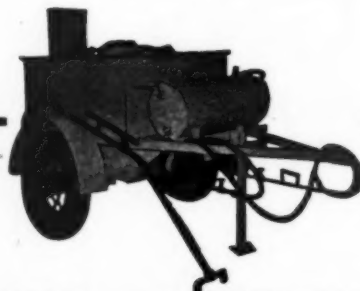
Write for New Illustrated
Folder.

MANUFACTURED BY



Lewis Manufacturing Co.
SAN ANTONIO 6, TEXAS

P. O. BOX
500



ASPHALT and TAR KETTLES

FIRE PROOF—OIL BURNING
Hand and Motor driven spray.
Many sizes. Write for catalog.

Elkhart **White Mfg. Co.** Indiana

Inquiry Blank and Advertisers' Index

Check reference to advertisement or to items of equipment or materials on which you wish to receive information. Give your name and address in the space at foot of page (if convenient, please print or use typewriter), detach page and mail to ROADS AND STREETS, Readers' Service Department, 22 West Maple Street, Chicago 10, Ill. We will pass your inquiry along to manufacturers and see that you get desired information promptly.

Check below advertisements on which you wish information on products featured:

*Adams Mfg. Co., J. D.	Second Cover	Flintkote Co.	35	*Oliver Corp.	29
Allied Steel Products Co.	125	Ford Motor Trucks	25	Owatonna Tool Co.	110
*Allis-Chalmers, Tractor Division	11	*Gallon Iron Works & Mfg. Co., The	21	*Owen Bucket Co., The	123
American Cable Division	Third Cover	*Gar Wood Industries, Inc.	39-43	Perfection Steel Body Co.	113
American Steel & Wire Co.	93	Gemmer Mfg. Company	9	Rapid Pavement Breaker Co.	124
Armco Drainage & Metal Products, Inc.	4	Gulf Oil Corporation	36	*Rogers Brothers Corporation	122
Associated Equipment Distributors	105	*Hanson Clutch & Machinery Co.	116	Rogers, Glenn M.	119
*Austin-Western Co.	42	*Harnischfeger Corporation	48	*Sauerman Bros., Inc.	121
Auto Gear & Parts Co.	85	Hazard Wire Rope Division	Third Cover	*Shunk Mfg. Co.	125
*Barber-Greene Co.	44	*Heil Co.	37	Standard Oil, Ind.	38
*Bethlehem Steel Co.	1	Hetherington & Berner, Inc.	118	Standard Oil, Ind.	38
Blackhawk Mfg. Company	33	*Highway Equipment Company	121	*Texas Co., The	56, Back Cover
*Bros Boiler & Mfg. Co., Wm.	8	Huber Mfg. Co., The	45	*Thew Shovel Co., The	3
Buckeye Traction Ditcher Co.	40	Independent Pneumatic Tool Co.	53	*Timken Roller Bearing Co.	Front Cover
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Calcium Chloride Assn.	112	*International Salt Company, Inc.	55	Unit Crane & Shovel Corp.	19
Carlisle Rubber Company	125	Jackson Vibrators, Inc.	117	United States Steel	93
Cataphote Corp.	125	*Jaeger Mach. Co., Inc.	23	*Universal Road Machinery Co.	124
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Dixon Valve & Coupling Company	128	Mack Trucks, Inc.	87		
Dodge Div. (Chrysler Corp.)	20	*Marmon-Herrington Co., Inc.	97		
*Electric Tapper & Equip. Co.	117	McCarter Iron Works, Inc.	124		
*Etnyre and Company, E. D.	120	*Michigan Power Shovel Co.	120		
Euclid Road Machinery Company	15	M.R.S. Mfg. Co.	88		
Firestone Tire & Rubber Company	17	Northwest Engr. Co.	5		
Flink Company	115				

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Check other products below on which you wish us to obtain information for you:

AGGREGATE:	<input type="checkbox"/> Truck Mounted	<input type="checkbox"/> Diesel	<input type="checkbox"/> Concrete Vibrators
<input type="checkbox"/> Bins and Hoppers	<input type="checkbox"/> Piledrivers	<input type="checkbox"/> Electric	<input type="checkbox"/> Drills, cable tool
<input type="checkbox"/> Conveyors			<input type="checkbox"/> Drills, tripod and wagon
<input type="checkbox"/> Crushers	GRADERS:	ROLLERS:	<input type="checkbox"/> Drills, rock, hand-held
<input type="checkbox"/> Portable Plants	<input type="checkbox"/> Blade, self propelled	<input type="checkbox"/> Power (Smooth)	<input type="checkbox"/> Paint Sprayers
<input type="checkbox"/> Screens	<input type="checkbox"/> Blade, pull type	<input type="checkbox"/> Pneumatic Tire	<input type="checkbox"/> Paving Breakers
BITUMINOUS:	<input type="checkbox"/> Blade, under truck	<input type="checkbox"/> Sheepfoot	<input type="checkbox"/> Riveters and Chippers
<input type="checkbox"/> Batches	<input type="checkbox"/> Elevating	TRACTORS:	MISCELLANEOUS:
<input type="checkbox"/> Finishers	LOADERS & TRENCHERS:	<input type="checkbox"/> Crawler	<input type="checkbox"/> Buildings, portable
<input type="checkbox"/> Distributors	<input type="checkbox"/> Front-end loader (tractor mounted)	<input type="checkbox"/> Rubber-Tired	<input type="checkbox"/> Earth Drills, power
<input type="checkbox"/> Dryers	<input type="checkbox"/> Loader, bucket type and belt type	TRACTOR EQUIPMENT:	<input type="checkbox"/> Light Plants
<input type="checkbox"/> Heaters	<input type="checkbox"/> Trencher or Ditcher	<input type="checkbox"/> Dozers	<input type="checkbox"/> Lubrication, Service Truck
<input type="checkbox"/> Plants (central)	HAULING EQUIPMENT:	<input type="checkbox"/> Power Control Units	<input type="checkbox"/> Mowers, Highway
<input type="checkbox"/> Plants (travel)	<input type="checkbox"/> Dump Trucks, self-powered	<input type="checkbox"/> Rippers	<input type="checkbox"/> Power Saws
CONCRETE:	<input type="checkbox"/> Dump Wagons, tractor drawn	<input type="checkbox"/> Scrapers, tractor drawn	<input type="checkbox"/> Soil Stabilizing Equipment
<input type="checkbox"/> Batches	<input type="checkbox"/> Flatbed Trailers	<input type="checkbox"/> Scrapers, self-powered	<input type="checkbox"/> Snowplows, rotary
<input type="checkbox"/> Buggies and Carts	<input type="checkbox"/> Other Trucks	BUCKETS:	<input type="checkbox"/> Snowplows, v or wing
<input type="checkbox"/> Finishers	PUMPS:	<input type="checkbox"/> Clamshell	<input type="checkbox"/> Spreaders, sand or cinders
<input type="checkbox"/> Joints, Expansion and Contraction	<input type="checkbox"/> Centrifugal	<input type="checkbox"/> Concrete	<input type="checkbox"/> Street Flushers
<input type="checkbox"/> Reinforcement Accessories	<input type="checkbox"/> Concrete	<input type="checkbox"/> Dragline	<input type="checkbox"/> Street Sweepers
<input type="checkbox"/> Metal Road Accessories	<input type="checkbox"/> Diaphragm	<input type="checkbox"/> Orange Peel	<input type="checkbox"/> Welders
<input type="checkbox"/> Mixers (under 1 yd.)	<input type="checkbox"/> Mud Jacking	SHOVELS & DRAGLINES:	<input type="checkbox"/> Cutting Torches
<input type="checkbox"/> Mixers (1 yd. up)	<input type="checkbox"/> Piston	<input type="checkbox"/> Crawler (under 1 yd.)	<input type="checkbox"/> Hydraulic Jacks
<input type="checkbox"/> Pavers	<input type="checkbox"/> Wellpoint	<input type="checkbox"/> Crawler (1 yd. up)	<input type="checkbox"/> Hydraulic Control Equipment
<input type="checkbox"/> Reinforcing Steel	POWER UNIT:	<input type="checkbox"/> Truck Mounted	<input type="checkbox"/> Hand Tools
<input type="checkbox"/> Road Forms (1000' set)	<input type="checkbox"/> (Independent)	ROCK DRILLS & AIR TOOLS:	<input type="checkbox"/> Hoists, derrick type
<input type="checkbox"/> Tower	<input type="checkbox"/> Gasoline	<input type="checkbox"/> Air Compressors	
<input type="checkbox"/> Truck Mixers		<input type="checkbox"/> Backfill Tampers	
CRANES:		<input type="checkbox"/> Clay Diggers	
<input type="checkbox"/> Crawler Mounted			

Be sure to fill in name and address below:

Your Name Title
 or profession
 Name of your company
 or governmental department
 Type of work for which
 equipment will be used
 Street Address
 City State County

Designed to Cut Drilling Costs Three Ways!

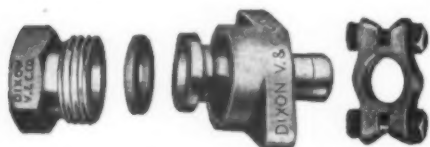
The couplings described below assure a three-way saving on rock drilling and other air tool operations.

- 1 Superior strength and durability give them longer service life.
- 2 Their tight, leakproof grip on the hose eliminates all possibility of pressure losses.
- 3 Efficient design and smooth finish prevent damage to hose ends.



"G J-BOSS" AIR HAMMER COUPLING

Ground joint construction—no worn or mis-laid washers to replace. Built for heavy duty and hard wear. Compact and heavy types. Furnished with strong "Boss" Interlocking Clamp. Cadmium plated—rustproof. For washer style, specify "Boss" Air Hammer Couplings.



"DIXON" AIR HAMMER COUPLING

Washer style. Efficient, durable, inexpensive. Steel stem has deep, smoothly finished corrugations. Strong malleable iron clamp has dual gripping ridges on inner surface. Large malleable iron wing nut facilitates connecting and disconnecting. Compact and heavy types. Cadmium plated—rustproof. Also available in ground joint construction—specify "G J-Dixon" Air Hammer Couplings.

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Always 100% Efficient

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